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of the
American Veterinary Medical Association

FORMERLY

AMERICAN VETERINARY REVIEW

(Original Official Organ U. S. Vet. Med. Ass'n.)

EDITED AND PUBLISHED FOR

The American Veterinary Medical Association

CONTENTS

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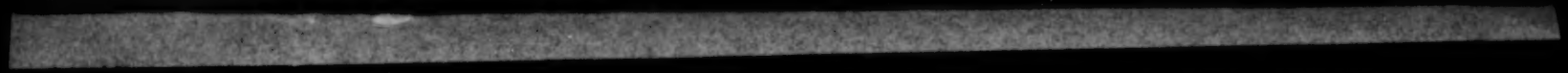

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H. Preston Hoskins, Secretary-Editor, 716 Book Building, Detroit, Mich.

Vol. LXXII, N. S. Vol. 25 **March, 1928** **No. 6**

EXTRA MEASURE AGAIN

This month we are publishing the proceedings of another meeting of the United States Live Stock Sanitary Association—the thirty-first annual—held in Chicago three months ago. When this cooperative arrangement was launched last year, we asked for expressions of opinion from our members. Of those who took the trouble to express their views we are able to say that they were unanimously in favor of the idea. Of course, we can not speak for those who have remained silent and must assume that silence gives consent.

As pointed out one year ago, by placing before our readers all the addresses, papers, discussions and reports of the annual meeting of the United States Live Stock Sanitary Association, in addition to the proceedings of the annual meeting of the American Veterinary Medical Association, through the medium of the JOURNAL each year, we are making conveniently available to the profession a large share of the new information concerning the more important animal diseases—tuberculosis, abortion, hog cholera, bacillary white diarrhea, rabies, Texas fever, parasitisms and nutritional distrubances, as well as other subjects of a general character, all affecting veterinarians, either directly or indirectly.

Although this issue is twice the regular size, it goes to our members and subscribers as no extra charge to them. The U. S. L. S. S. A. bears a proportionate part of the expense, but by far

the larger part is borne by the A. V. M. A., according to the arrangement now in effect. It is doubtful if our sister organization could have kept on publishing its own proceedings, as previously, due to the increasing amount of material constituting the report each year and the resulting increased cost of publication.

One additional thought at this time. Many members of the A. V. M. A. are members of the U. S. L. S. S. A. These men will receive two copies of the report, one in this form and another under the usual cover of previous U. S. L. S. S. A. reports. Some may think they have no use for two copies of the report and discontinue paying dues in the U. S. L. S. S. A. Do not do this. Continue to support the U. S. L. S. S. A. and if you have no use for the extra copy of the report, place it in the hands of some veterinarian or other person interested in the control of animal diseases, not already a member of the U. S. L. S. S. A.

IMPORTANT NOTICE

Although this is the sixth number of the current volume of the JOURNAL, it is not the index number. The next number (April) will conclude volume LXXII (new series 25) and will contain the index. This arrangement provides for seven numbers in the present volume, instead of the usual six. The two volumes following (LXXIII and LXXIV) will consist of seven numbers, as well. Volume LXXIII will end with the issue of November, 1928, and volume LXXIV with June, 1929. From then on, all volumes will consist of six numbers and volumes will begin with the issues of January and July each year. There will continue to be two volumes per year, as at present, but these will be completed within each calendar year. At the present time each even-numbered volume is divided between two calendar years. We hope that much confusion in volume numbers will be avoided after the new arrangement becomes established.

OHIO STATE UNIVERSITY CONFERENCE

The third annual veterinary conference of the College of Veterinary Medicine, Ohio State University, will be held March 21-22-23, 1928. This year it is proposed to devote one of the three days of the conference to sessions in veterinary art exclusively. Leaders in horse, cattle, swine, poultry and small-animal practice, respectively, will be chosen to bring out, as far as

possible, the latest and the best in veterinary practice and to do so from the angle of the routine practitioner, giving him something he can actually take home with him and use in his practice, to the advantage of the live stock owners of the community. The remaining two days will include a good program well worth hearing and discussing.

Through the conference the University hopes to reach the animal husbandry of the State, employing the veterinarian as its medium of communication. To attempt to deal with the live stock owner in any other way is illogical and therefore unsound and impractical. The University hopes the profession will appreciate what is being attempted here and cooperate with it this year, and in future years, as it has in the past. Veterinarians of Ohio and neighboring states are invited to help put this program across.

APPLICATIONS FOR MEMBERSHIP

See October, 1927, JOURNAL

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D. V. M., Kansas City Veterinary College, 1917
Vouchers: Fred C. Cater and J. D. Ray.

MORGAN, DAVID B. Neosho, Mo.
V. S., Ontario Veterinary College, 1905
M. D. V., McKillip Veterinary College, 1906
Vouchers: Ralph Graham and J. D. Ray.

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D. V. M., Iowa State College, 1921
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D. V. M., Kansas City Veterinary College, 1915
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M. D. V., McKillip Veterinary College, 1910
Vouchers: H. S. Wooters and C. C. Hastings.

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D. V. M., Kansas City Veterinary College, 1914
Vouchers: L. H. Adams and A. T. Kinsley.

SCHNEIDMAN, SAMUEL A. 207-19 Jamaica Ave., Bellaire, L. I., N. Y.
D. V. M., Cornell University, 1915
Vouchers: Earl Sunderville and C. E. Hayden.

SEEVERS, FRED L. Pleasant Hill, Mo.
D. V. M., Kansas City Veterinary College, 1915
Vouchers: Fred C. Cater and J. P. Ray.

SHIPP, REUBEN S. Cameron, Mo.
D. V. M., Chicago Veterinary College, 1920
Vouchers: J. D. Ray and J. S. Barbee.

SPESARD, W. R. Shelbyville, Ill.
D. V. M., McKillip Veterinary College, 1914
Vouchers: H. S. Wooters and C. C. Hastings.

SUITS, FRANKLIN H. Odessa, Mo.
D. V. M., Kansas City Veterinary College, 1916
Vouchers: J. D. Ray and J. S. Barbee.

TOMLINSON, GEORGE ROLLAND
634 Live Stock Exch. Bldg., South St. Paul, Minn.
V. S., Ontario Veterinary College, 1903
M. D. C., Chicago Veterinary College, 1904
Vouchers: G. E. Totten and Irvin Owens.

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Berthelson, J. G., Alamosa, Colo.
Blanche, George W., 831 Milford, Glendale, Calif.
Bolstad, Bernard M., Appleton, Minn.
Burdick, E. E., Huron, S. Dak.
Coffey, Russell F., Eskridge, Kans.
Cook, Robert A., 924 Del Paso Blvd., Sacramento, Calif.
Cowan, Harold Wales, 11053 83rd Ave., Edmonton, Alta.
Dicke, William Marion, Paola, Kans.
Given, Josiah A., Marcus, Iowa.
Haag, Walter M., Box 11, Arabi, La.
Haimbaugh, George Dow, Rochester, Ind.
Hamilton, Chester M., Western Washington Exp. Sta., Puyallup, Wash.
Hamner, Robert H., 44 Post Office, Birmingham, Ala.
Hawkins, I. L., Cascade, Iowa.
Kile, J. C., West Jefferson, Ohio.

Le Fevre, Daniel D., 125 W. Miller St., Newark, N. Y.
McClure, Will E., Hutchinson, Kans.
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Middlehoff, Gerret Earle, Oroville, Calif.
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Pierson, Ira J., Box 64, Lawrence, Kans.
Ritter, W. J., Creston, Nebr.
Schalk, Karl W., Iowa Falls, Iowa.
Schlaegel, Merrill Philip, Burr Oak, Kans.
Schrag, Otto J., Box 236, Freeman, S. Dak.
Sherrill, Bert O., 929 Park Ave., Indianapolis, Ind.
Smith, H. G., Exira, Iowa.
Stearns, Troy Joseph, Box 161, Russellville, Ky.
Stuart, James E., State Dept. of Agr., Capitol Bldg., Sacramento Calif.
Tarbill, Leslie M., Mt. Sterling, Ohio.
Weimer, Frank D., Cumberland, Iowa.
Whitaker, Ross Landess, Fayetteville, Tenn.
Wolf, Otto Ernest, Big Spring, Texas.
Youngblood, Robert Walker, Henderson, Ky.

REINSTATED

McKim, H. C., Los Angeles Union Stock Yards, Los Angeles, Calif.

The amount that shall accompany an application filed this month is $9.16, which covers membership fee and dues to January 1, 1929, including subscription to the JOURNAL.

COMING VETERINARY MEETINGS

New York City, Veterinary Medical Association of. Academy of Medicine, 5th Ave. & 103rd St., New York, N. Y. Mar. 7, 1928. Dr. C. P. Zepp, Secretary, 128 W. 53rd St., New York, N. Y.

San Diego-Imperial Veterinary Medical Association. San Diego, Calif. Mar. 7, 1928. Dr. W. G. Oliver, Secretary, 3821 Arizona St., San Diego, Calif.

Chicago Veterinary Society. Great Northern Hotel, Chicago, Ill. Mar. 13, 1928. Dr. J. B. Jaffray, Secretary, 2956 Washington Blvd., Chicago, Ill.

Southeastern Michigan Veterinary Medical Association. Detroit Mich. Mar. 14, 1928. Dr. H. Preston Hoskins, Secretary, 716 Book Bldg., Detroit, Mich.

Kansas City Association of Veterinarians. New Baltimore Hotel, Kansas City, Mo. Mar. 20, 1928. Dr. J. D. Ray, Secretary, 400 New Centre Bldg., Kansas City, Mo.

Southern California Veterinary Medical Association. Chamber of Commerce Bldg., Los Angeles, Calif. Mar. 21, 1928. Dr. W. L. Curtis, Secretary, 1264 W. 2nd St., Los Angeles, Calif.

Illmo Veterinary Medical Association. Edwardsville, Ill. Mar. 22, 1928. Dr. L. B. Michael, Secretary, Collinsville, Ill.

Ohio State University Conference of Veterinarians. Columbus, Ohio. Mar. 21-22-23, 1928. Dr. D. S. White, Dean, Ohio State University, Columbus, Ohio.

Report of the Proceedings

of the

Thirty-first Annual Meeting

of the

United States Live Stock Sanitary Association

Chicago, Illinois, November 30, December 1-2, 1927

WEDNESDAY MORNING, NOVEMBER 30, 1927

The opening session of the thirty-first annual meeting of the United States Live Stock Sanitary Association, held at the La Salle Hotel, Chicago, Illinois, was called to order at 10:25 a. m., by President L. Van Es.

PRESIDENT VAN ES: Members of the United States Live Stock Sanitary Association and Guests: I bid you welcome to this meeting, which I now declare in session.

The first item on the program is an address by a man we all know, one who does not need any special introduction. He has been here before and has always enlightened us on some very fundamental things pertaining to our field of work. If he needs any introduction, I will introduce him again. Dr. W. A. Evans, of Chicago. (Applause)

DR. EVANS: Mr. Chairman and Gentlemen: I am sure I feel about it just as Dr. Van Es does.

Dr. Dyson tells me you are thirty-one years old as an organization. I have had the pleasure of coming here periodically for a good many years. My acquaintance with you is not thirty-one years old, but it has been long and very pleasant.

For many years it has been my privilege and my pleasure to come before this organization at times to talk to you, and at other times to listen to you. I believe that I can feel or sense or appreciate the development of your science, and particularly your organization, rather better by reason of the fact that my contacts are intermittent, than can you who are constantly in touch with them. The pleasure, therefore, and the profit of being here is very great—a pleasure and a profit that is personal and, at the same time, scientific.

My interest is in public health, and by that I mean human public health, as I often explain. I have picked up a great deal from your meetings and from your transactions that I think has been of some service to me in public health work amongst human beings.

Contrary to that which has been my habit—and I believe that I can, with some degree of propriety, term it a habit—I have prepared something, and I am going to read what I have to say today rather than to speak extemporaneously. I am going to talk on the subject of some of the diseases which man shares with the lower animals.

. . . Dr. Evans read his paper. . . . (Applause)

PARASITIC DISEASES SHARED BY MAN AND ANIMALS

By W. A. Evans, *Chicago, Ill.*

Man is on friendly, live-and-let-live relations with most yeasts, molds and bacteria. This seems to be the normal relationship. This adjustment causes us to regard most bacteria as saprophytic.

Short of perfect adjustment there is one that approximates it in perfection. To it we apply the term parasitism.

On the way towards parasitism there is a state called pathogenesis which, to the pathologist and the clinician, is of more interest than all the other phases of evolution toward adjustment. The microorganisms which are in this way-stage, called pathogenesis, are responsible for all the communicable diseases to which man is subject.

Man survives racially and, in most cases, individually, in the warfare called disease. He is the conqueror as well as the survivor. It follows that the pathogenic bacteria must have some retiring place into which they can escape and perpetuate themselves. Various animals and insects, the soil, and other environmental havens are employed for this purpose.

While all of what has been said above relates to humans, and to human diseases, parallel statements can be made as to lower animals and their diseases.

Fortunately for us, and also for the lower animals, the rule is that human beings do not share their diseases with the lower animals.

With many of these lower animals man lives in very close association; at times, more intimately than with his fellow men. Why do they not exchange diseases? We say disease is spread by kissing. Women kiss dogs. Why do they not exchange diseases? We say that disease is spread by the common use of plates. Cats and people often eat out of the same plates, with no complete sterilization in between. Why no interchange of bacteria?

The answer is that the host relationship is just as specific as are the other relationships of bacteria. This, while a source of great protection to man, in most instances, is a source of embarassment in some. The laboratory worker—both the research worker and the clinical laboratory man—finds himself seriously handicapped by this specific relationship, between host and pathogenic

parasite, when he comes to study certain diseases. It is the lack of such specificity as a host which makes the guinea pig of such great value in laboratories.

Even though it be established that man shares a certain disease with a lower animal, it does not follow that that fact is of any great importance. Basically, any source of an important disease is of some importance. It represents one more place in which the disease is maintaining itself, one field where the bacteria are in existence in their pathogenic phase, ready and prepared to invade the human host.

However, this aspect of the question is not as important, when we view the matter as one of evolution through pathogenesis to parasitism, or saprophytism—an evolution toward adaptation—as it is when we view it as a war of extermination.

* * *

But beyond this field, which we may call academic importance, there is that which is of practical, or economic, importance. Some of the factors which enter into the question of practical importance are as follows: Is the disease costly in lives, health, efficiency, money? That is, costly to human beings, to lower animals, or to both.

Is there a host symbiosis, and is such relationship essential for the continuance of the disease? By way of illustration: the symbiosis of the host relationship of humans and mosquitoes to malaria.

Does either animal serve as a reservoir for the enemy micro-organism, feeding it back as a pathogenic organism to the other in some essential way?

Is the organism as it is found in any animal species a dead end? Is it incapable of infecting animals of a different species?

Is there practical, easy transmissibility of the enemy organism from the human host to the lower animal host, or vice versa?

With these points in mind, we will briefly consider some of the diseases which man shares with the lower animals.

The following is a list which embraces practically all the diseases which man shares with the lower animals in this country and Europe. There is a varying amount of proof as to these several diseases. These facts, surmises and theories will be briefly discussed.

Tuberculosis, anthrax, glanders, tetanus, hydrophobia, plague, typhus, undulant fever, tularemia, foot-and-mouth disease,

syphilis, yellow fever, malaria, typhoid fever, and infections due to a group of Salmonella organisms.

Diphtheria, whooping cough, mumps, scarlet fever, measles, erysipelas, the pus infections, pneumonia and rheumatism.

Influenza, anterior poliomyelitis, carcinoma and sarcoma, various kinds of worm infestation, favus, ringworm, mange, and other skin infections due to parasites.

Smallpox, and the other poxes, milk sickness, rat-bite fever, sleeping sickness, infective jaundice, Rocky Mountain spotted fever, and botulism.

Tuberculosis

Tuberculosis is far more nearly ubiquitous than is any other disease. It is of practical importance as a disease of both man and the lower animals. It is fairly readily transferable from animals to man, and it may be transferable in the reverse direction.

I accept what I understand to be the teaching of Schroeder as to the mammalian tubercle bacillus. It is that there are three main divisions of this bacillus: the bovine, the human and the avian. The bovine bacillus is the main stem and the human bacillus and the avian are the derivatives thereof. The human bacillus is considerably of a dead end. It is virulent for men—more so than the bovine—but is only slightly pathogenic for lower animals. The bovine bacillus is pathogenic for lower animals and moderately so for humans.

The danger of infection of human beings from lower animals is moderately great. The danger of infection of lower animals by human beings is not great.

Anthrax

Anthrax is of importance, and yet, the fact that animals are subject to it is not a major factor in the disease in man. There is no direct communicability of the diseases from a sick animal to man, or from a sick man to a lower animal. Certain products of dead animals, such as hides and hair, are important sources of infection in man, but that is a little beside the question now under discussion.

Neither man nor any lower animal is a reservoir for anthrax. The organism excites too much reaction for that. It is too pathogenic and too far removed from the parasitic for that. The reservoir is the soil, or some worm or insect in the soil.

I accept the correctness of the Besredka opinion that the skin supplies the determining factor in susceptibility and immunity to anthrax. These facts are, in some measure, the logic of the statement that anthrax in animals is not an important source of direct contagion to man. The reverse also is true.

Glanders

I do not know much about glanders, but my understanding is that glanders in the lower animals is a source of infection to man, but that, practically speaking, lower animals do not get glanders from man. If glanders in man was prevalent enough to make it an important disease it would attract attention because it meets some of the basic requirements laid down above.

Man can be infected by lower animals. I know of no proof that man has ever infected lower animals.

Tetanus

The conditions with tetanus (almost) parallel those with anthrax. The reservoir is the soil, or some worm or insect therein; the organism is too pathogenic for both man and lower animals; too much removed from pure parasitism or saprophytism for anything approximating reservoir conditions. A lower animal having tetanus does not directly endanger man, and vice versa.

Hydrophobia

As far as we know, the only reservoir for hydrophobia is the lower animal. While we think of the disease as being terrible, there is some reason for thinking certain lower animals, and perhaps man, are approaching adjustment with the major etiologic factor in hydrophobia. This is the meaning of the prolonged incubation period of this disease—an incubation period which has been known to approximate a year. It is probably the explanation of the great efficacy of the original Pasteur vaccination, a crude, rule-of-thumb product.

Hydrophobia in man is not a hazard to man or to any lower animal. Hydrophobia in lower animals is a source of hazard to man.

Plague

Bubonic plague affects rats and men. It has been, and in parts of the world still is, a disease of enormous importance to both. The medium of interchange of the disease is a flea, cheops.

In India, the visitation of the disease to man can be forecast when rats are discovered to be dying, and, when men are dying by the hundreds, dead rats are soon found lying around.

While it has been recently proposed that the fight against human plague be based upon the prevalence of cheops, it is a fact, and has been for years, that our own and other governments base their plague campaigns upon what they observe of infection among rats and other rodents. No further reason need be given for the statement that the common susceptibility of man and lower animals to plague is important.

It seems probable that man can infect rats and rodents, just as rats and rodents can infect man. A recent report of a rat carrier of plague suggests the possibility that the rat is or may be a plague reservoir.

Typhus Fever

Maxcey surmises that the rat, or some animal on that plane, may be the reservoir for typhus. Man has two, and maybe three, forms of typhus: malignant typhus, or ship fever, starvation fever, prison fever, or Mexican typhus; Brill's disease, or modified, mild typhus; and a newly described form, which I shall here term, "Maxcey typhus." The evidence shows that typhus is spread by lice. We know of no reservoir for old-fashioned typhus except the human case, if we are justified in calling cases reservoirs. If there are carriers, that fact is not known. As to Brill's disease, we know little.

As to Maxcey typhus, described by the author as being occasionally prevalent in the southeastern part of the United States, the author (Maxcey) says the epidemiologic behavior of the disease indicates that there must be an animal host, and he suggests the rat as such host. He thinks the rat may be a reservoir.

Undulant Fever

This disease was first described as Malta fever. It was found as a disease of human beings and of goats on the island of Malta. It was found to be due to *Bacillus melitensis*, which was conveyed to human beings through the medium of goat's milk.

In goats the disease appears to be nearing the stage of complete adjustment, not causing much constitutional disturbance in that animal. In the main, he or she is a latent carrier. It was later found that so-called Malta fever and goat carriers of *B.*

melitensis were encountered in the United States and elsewhere outside of Malta.

The next discovery was the discovery that undulant fever in human beings, a fairly prevalent malady, was due to drinking raw milk containing the bacillus of contagious abortion. It appears that this *B. melitensis* and its variants is comparable with the tubercle bacillus in its capacity for infecting man and many species of the lower animals.

That man can be infected by goats and cows through milk is certain. Whether goats and cows can be infected by man, I do not know.

Tularemia

The disease affects at lease one species of lower animals, the rabbit, as well as man. Whether the epidemics which sometimes kill off wild rabbits, such as one of which I have heard, are caused by the *Bacillus tularensis*, or not, I do not know.

That man can be infected from rabbits is known. Whether rabbits can be infected by man is not known.

Foot-and-Mouth Disease

There is one well authenticated case of human foot-and-mouth disease in the United States—that reported by Sutton. There are a multitude of such cases reported from Europe. These cases can usually be traced to infection from animals. There is no evidence of infection of animals by man. There is no evidence as to whether there is a reservoir for this disease.

* * *

As to the next two diseases, the evidence as to animal relationship is purely speculative.

Syphilis

Syphilis is a disease of man. It can be experimentally transferred to certain apes, and to rabbits, but there is no evidence that it is ever a disease of these animals except under laboratory conditions. It is not certain that any lower animal in its natural state is subject to syphilis.

Mal du coit of horses is not syphilis. But there is a closely related disease of humans, supposed by many to be a variant of syphilis. It is known as yaws. It is claimed that llamas are subject to yaws, and from these somewhat associated facts it has been suggested that syphilis may have come from tropical regions, and even from America; that it is a derivative of yaws; and that

the llama is associated with man in the propagation of the disease.

Yellow Fever

In Africa, and perhaps in Central America, and the northern part of South America, yellow fever behaves epidemiologically very like a disease with a reservoir. The natives of some countries in those regious seem to have nearly reached the stage of adjustment and peaceful neighborliness with the organism of this disease. There are claims that the disease is found in some of the higher monkeys, and that these wild animals are the reservoir for yellow fever. This is highly speculative, as is the theory that the native people of some of these regions, often half wild, are the reservoir.

So far as we know, no domestic animal has yellow fever or is infective to man, or is infected by man.

Malaria

Some of his observations on bird malaria were the basis of some of Roland Ross' discovery of human malaria. The same may be said of Theobold Smith's observation on tick fever, though there is no claim that tick fever is a form of malaria.

However, there is some reason for thinking there is relationship between bird malaria and human malaria. Some of the therapeutics of human malaria is based upon the use of drugs in bird malaria. However, there is no evidence that bird malaria stands in any direct causative relation to human malaria.

Humans are infected by mosquitoes which, in turn, have been infected by humans. Mosquitoes capable of spreading malaria are fond of feeding on various of the lower animals, but there is no evidence that they suffer from malaria, or that mosquitoes infect them, or that they infect mosquitoes.

On the other hand, the large number of chronic carriers of malaria, most of whom rarely have attacks of chills and fever, and many of whom are not definitely sick though they are debilitated, indicates that man is approximating a state of compromise with malaria, and is a malarial reservoir.

Practically speaking, so far as our information goes, man neither infects lower animals nor is infected by them.

Typhoid Fever and the Infections Due to a Group of Salmonella Organisms

Savage and White contend that the typhoid bacillus is an off-shoot—a branch—of the great Salmonella tree. On this tree

are paratyphoid A and B, and many organisms, most of which cause intestinal infections. If this be true, then typhoid may have evolved, or may be evolving, from some of the other bacteria of the group. It is known that while most of these infections cause diarrhea, some of them produce fevers that are distinguished from typhoid fever with great difficulty. This is particularly true of the paratyphoid infections. This view cannot be dismissed lightly. It brings rats, and perhaps other lower animals, into the typhoid picture, at least in a speculative way.

Putting aside these speculative considerations, we find no direct and practical relationship in the typhoid field between man and the lower animals. No lower animal is subject to typhoid fever. On the other hand, man shows a very considerable capacity for mutual adaptability to the typhoid bacillus. It is estimated that at least two per cent of human beings who have recovered from typhoid remain latent typhoid carriers. In the warmer sections of the country, for instance, Alabama, it is thought that this percentage mounts to at least eight. This indicates that man is the great reservoir for typhoid.

The lower animals neither infect man nor are infected by man.

Diphtheria and Whooping Cough

The evidence as to diphtheria and whooping cough in the lower animals is contradictory.

Scarlet Fever, Measles, Pneumonia, the Pus Infections and Rheumatism

These are grouped together because of the prominence of varieties of streptococci among the microorganisms which cause them.

Two methods have been devised for causing horses to react to the streptococcus of scarlet fever. However, the disease is not supposed to exist outside of the laboratory in lower animals. We do recall, however, a marked tendency to scarlet fever-like eruptions in hog cholera, and other diseases of lower animals, a tendency which lead to error in the case of the supposed Class coccus for scarlet fever.

Goats have been used in the production of protective substances against measles, but measles is not known to exist in the lower animals outside laboratory conditions.

There is no evidence that man is ever infected with scarlet fever or measles by lower animals or vice versa.

Nothing is known of any reservoir for either of these diseases though human latent scarlet fever carriers are now recognized.

Pneumonia and rheumatism are both widespread diseases among the members of both the human family and the families of the human animals. It is too early to say what are the possibilities of infection back and forth between the two levels.

The Pus Infections

The lower animals are relatively immune to suppurations of wounds, boils and abscesses, that is, as compared with man. Nevertheless, it is proper to say that there is a group of pus infections which man shares with the lower animals.

Influenza

There is every epidemiologic reason for thinking that influenza has a reservoir into which it returns, breaking out and spreading as a pandemic only at long intervals. It is generally assumed that this reservoir is in some faraway region. Eastern Russia has been suggested. This suggestion may be true as regards the major reservoir, but experience with the recurring epidemic waves, generally somewhat localized, which follow the pandemic waves, suggests that secondary reservoirs lie closer (at hand).

There was no lower animal involvement of any kind in the pandemic influenza waves of 1890 and 1918, but that of 1871 was accompanied by a widespread and devastating wave of epizootic among horses. However, in this pandemic the reaction of the animals indicated that the disease was new to them. It did not indicate that horses were a reservoir for the disease. There is no proof that the epizootic in horses of 1871 was due to influenza.

There was no evidence in 1918 that man got influenza from lower animals, or vice versa.

Anterior Poliomyelitis

The epidemiology of this disease in humans is strongly indicative of a reservoir. It is transmissable to monkeys under laboratory conditions. An effort has been made to connect the disease with "limber neck" in fowl. It is not generally held that there is a relationship between these two diseases. Nor is there present proof that any lower animal is the reservoir of anterior poliomyelitis.

We have no proof that, under ordinary domestic conditions, infantile paralysis is conveyed from man to lower animals or vice versa.

Cancer, Including Sarcoma

Both man and lower animals are prone to various forms of malignant tumors. The disease has the same histology in the two sets of animals. In the main it pursues the same clinical course. We know very little about the infectivity of malignant tumors, but in what we know, the infectivity follows the same general lines in the two planes.

But there is nothing to indicate that cancer in man hazards the lower animals, nor vice versa.

The Worms

Under this head I include the various tapeworms, trichina, and the round worms.

In this field, in the main, the human animal and the lower animal cooperate to supply the needs of the parasite for its complete cycle. The relationship might be called symbiosis. It might be proper to say that each animal plane is a reservoir, feeding parasites to the other. Each is complemental to the other. The condition is more nearly one of parasitism than of pathogenesis, though under certain circumstances there is enough reaction to place the organism in the pathogenic field. Such are the cases of hookworm that develop severe anemia; the pneumonia occasionally produced by the wandering larvae, of nematode, round worm, the wandering larvae of trichina, and the echinococcus or measles stage of the tapeworms.

In no other field does the relationship of certain invading enemies to both man and the lower animals show more definitely. If the invading organism was pathogenic and less parasitic the interrelationship would be fraught with the greatest danger and hazard. The recent demonstration by Magath of the infestation of pike in the lakes near Ely, Minnesota, with a tapeworm, is a fine demonstration of this hazard, but it introduces no new principle.

Favus, Ringworm, Mange and Other Skin Infections Due to Parasites

It is accepted as proven that certain of the parasitic skin diseases which affect lower animals can be transmitted to man, and vice versa. And yet, there is very little evidence with us that man catches any great amount of skin diseases from the lower animals with which he associates, or that he conveys contagious skin disease to those associates. Such transfer is possible and occasional, but not frequent.

These animals and man do furnish common shelter and common source of sustenance to fleas, lice, bedbugs and mosquitoes, but none of these cause any but incidental skin trouble. Even at that, there is a great tendency to specificity of parasites. The fleas of one species never transfer to another level unless such transfer is unavoidable. At any rate, they regard such transfer as undesirable, and they make it temporary whenever they can.

Smallpox and the Poxes of the Lower Animals

Smallpox and allied disorders affect man and the lower animals. The several disorders are related. There is some possibility of the transfer of the disorder back and forth between animals, including man. But this, as a hazard, is incomparably overshadowed by the benefits to man of vaccination of man by the products of cowpox as a protective measure against smallpox.

Rat-Bite Fever

This is a disorder of rats which is occasionally transferred to man. As a disorder of man it is of minor importance. Man does not infect animals.

Sleeping Sickness

This is a disorder of large animals in South Africa which is fairly frequently transferred to man by the tsetse fly. The reservoir is supposed to be the wild buffalo, in whom the pathogenic organism lives in complete adjustment. It is an important disorder of both man and animals.

Weil's Disease, or Infective Jaundice

This is an infection of rats which occasionally breaks into the human family. The wild rat is supposed to be the reservoir. There is no proof that man is a source of danger to animals.

Rocky Mountain Spotted Fever

This is a disease of rodents which is occasionally transferred to ticks and bed bugs, to larger animals, and to man. In man it is a highly fatal disorder. So far as is known man does not infect the lower animals with the disorder.

Milk Sickness

Both man and the lower animals are subject to milk sickness. Furthermore, the only way man gets milk sickness is by drinking the milk from cows that have milk sickness.

Dogs and other animals get it from eating the meat of animals that have died of it.

The man who has the disease is not a menace to the lower animals.

Some years ago Jordan and Harris made a partial demonstration that milk sickness was a bacterial disease. This, however, is not the accepted view now. The opinion of the present day is that of one hundred years ago, to wit, that milk sickness is a poisoning due to an alkaloid or other chemical principle contained in certain varieties of white snakeroot grown on certain soils, and under certain atmospheric and seasonal influences.

Accepting this view, milk sickness is not a disease in the sense that we are discussing. However, it is a condition which is shared by man and the lower animals, its presence in these lower animals constituting a menace to man.

Botulinus Poisoning

Food poisoning due to the Salmonella group has been discussed. Botulinus poisoning is equally harmful to man and the lower animals. But it, too, is a poisoning, and not a disease and, therefore, beyond the scope of this paper.

* * *

Summarizing, we are struck with the fact that man and the lower animals share so few diseases. They live under such similar conditions, have environments that are so comparable, they share so much else—why is it they share so few diseases? The answer must lie along some undiscovered biologic lines.

We are especially struck by the small amount of evidence that man endangers the domestic animals. However, we may find that certain animals serve as reservoirs without giving any evidence that they are latent carriers. The adaptation is complete. When we know more about this phase of the subject we may discover that we hazard animals and animals hazard us in ways unsuspected now.

President Van Es: We all knew that Dr. Evans would tell us something worth while, but we hardly had reason to expect such a comprehensive paper on the epidemiology of human and animal disease. I am sure, Dr. Evans, I voice the sentiment of this organization when I thank you most cordially for this splendid effort.

I find the next number on the program is an address by your President, which evokes in me a sentiment of sympathy for this organization.

. . . President Van Es read his address. . . . (Applause)

THE ADDRESS OF THE PRESIDENT

By L. VAN ES, *Lincoln, Nebr.*

MEMBERS OF THE ASSOCIATION AND GUESTS:

Notwithstanding that this is the thirty-first meeting of the United States Live Stock Sanitary Association, gatherings of this kind serve as concrete evidence of a new era—an era which begins with a challenge of old and cherished beliefs and during which a new approach to truth was inaugurated. It witnessed the development of the experimental method of inquiry which, in the hands of the great masters of the nineteenth century, revealed disease as a biologic phenomenon not removed beyond the understanding of man.

The result of their labors became the foundation of a rational preventive medicine and hygiene and this, for so far as it can be applied to animal disease, moves us to come together in order to avail ourselves of a forum where an account may be given of experience acquired, where ideas may be exchanged, and where differences may be composed. We seek this opportunity to acquire wisdom so that the prevention of animal diseases may become more efficient and increasingly adaptable to the requirements of animal husbandry.

Efforts to prevent disease are as old as man himself, but it was not until our own period that they could be based on more exact knowledge and be made in a rational manner. This is among the highest achievements which the era in which our organization developed brought forth. It saw the newly acquired principles of prevention brought to bear upon the problems of disease. It saw their worth proven and it witnessed the gradual shifting from attempts to cure to efforts of prevention and sanitation.

Noble is the healing art which relieves suffering and which restores health; equally noble is the art which maintains health, which removes the causes of disease and which blocks its progress. Neither can be dispensed with, but it is particularly the latter upon which reliance must be placed when we have to cope with the disorders which are so apt to render animal husbandry a precarious undertaking.

The highest type of professional men must be attracted by this service and it may well be regarded as one of the tasks of this Association to do what lies within its power to remove whatever obstacle may now exist to the selection of a career in live stock

sanitation. A thorough training based upon the soundest scholarship should be merged with a high degree of civic responsibility to form the personal equipment of an ideal type of veterinary health officer. The citizenry of this and other lands may as well recognize at this time that such men will be urgently needed as time progresses and that they must be remunerated in a manner commensurate with that which prevails for the other learned professions.

* * *

Although the method of attack employed when dealing with the disease problem is manifestly shifting from the curative to the preventive, the former is still the major consideration in our veterinary curricula. There can be no doubt that a preparation for surgical and medical practice, as well as the exercise of practice itself, is of the greatest value to any one who is to deal with disease, even to those who will do so from the preventive side, but the time is here now that the veterinary course of a previous generation is no longer adequate for those who will come to function as live stock sanitarians.

As time progresses the value of prevention will be increasingly appreciated and in a not very remote future there will be a demand for leaders in live stock sanitation. It may be a long time before we will all be reconciled to the idea of a more or less generally applied state veterinary medicine, but there is evidence enough even now to indicate that the trend is in that direction.

At least the mass diseases of the food-producing animals will be managed as projects of public enterprise by sanitary organizations maintained by public support. To a very large extent this is being done now and while for some time to come the grower of live stock may continue to buy inert matter to put in the feed of animals or to subject his animals to absurd forms of vaccination, there are signs enough that he is becoming impatient with the costly attempts of this sort.

Not yet generally, but in steadily growing numbers, do stock growers turn to their live stock sanitary officers, not for a sackful of alleged medicine, but for enlightenment on the nature of disease and for counsel pertaining to measures of prevention. Slowly, but surely, we are bound to arrive at rational live stock sanitation guided and executed as a social enterprise. Therefore, our veterinary teaching institutions might well begin to study seriously the needs of a coming day, so that training facilities

may become available for the veterinary health officer of the future.

* * *

There can be no doubt that the control and eradication of the diseases of live stock is of prime importance in the maintenance of the public health. Tuberculosis, glanders, anthrax, rabies and parasitic diseases are prominent among these which may be communicated from animal to man and with their suppression the public health is correspondingly benefited.

It is, however, a tactical mistake to defend projects in live stock sanitation merely on the ground of their public relations. Live stock sanitation is of sufficient social economic importance to stand upon its own feet. It should not hide itself behind public health skirts, and the leaders responsible for its direction and guidance should not be compelled to plead its cause on the basis of human disease.

The right to exercise the police power of government in dealing with problems in bovine tuberculosis is sometimes sustained solely on the ground of its proven transmissibility to man by the judiciary, as if the protection of animal husbandry were a minor consideration.

The protective measures against fire and the full, unchallenged application of the power of government in their enforcement certainly was not founded altogether on the danger that somebody is liable to get burned. We should never fail to emphasize that the prevention of animal disease is a worthy cause *per se*.

In spite of the fact that writings on health and the art of preserving it are among the oldest, and notwithstanding the remarkable achievements of modern hygiene there still remains a vast volume of public and private opinion, uninformed, on disease, which constitutes a formidable obstacle to achievement in animal sanitation.

To a fairly large proportion of our stock-growing people the "cure" is the supreme salvation from disaster by disease and simple measures, by which a great number of diseases can be prevented, have no such charm. The amount of money annually thrown away on perfectly useless "cures" and "preventives" is manifold that which is devoted to rational control measures.

The man on the farm is, and will always be, the most important factor in live stock sanitation and the more he can learn about the influences which make disease transmission possible, the more

valuable will he become to the general suppression of disease, and the nobler will be his citizenship.

Thus, to enlighten him is a task of equal importance as the promulgation of regulatory measures, however useful and imperative the latter may be. To remove for him disease and its means of spread from the realm of the mystic, and to show it as a natural process, like the growing of grass and grain, will be more effective that the artful salesmanship which loads the stockgrower with tons of alleged remedies.

Not because this type of merchandise is in itself particularly harmful, but because the faith in it so often delays more promising efforts or causes them to be forgotten altogether. The faith in drugs, in mysteriously compounded and broadly advertised nostrums and fictitious immunizing concoctions is as often as not the most potential obstruction to progress in live stock sanitation.

Education and accurate information on the nature and ways of disease on sound animal husbandry and on the enlightened management of flocks and herds are the foundation upon which we must build if we are to make progress in the struggle against disease in a manner suitable to the needs of our time. It is part of our task to secure the light of understanding, to dispel the doubt, superstition, and the dishonest charlatanism still lingering among us as reminders of the dark ages.

* * *

In dealing with disease problems of social, economic or natural importance, it is essential to have available at any time the latest statistical evidence pertaining to morbidity, mortality, prevalence and geographic distribution. In this country the only useful statistics of animal diseases are those coming from slaughtering establishments, the tuberculosis campaigns and certain annual reports of live stock sanitary institutions. But few of these are at all comprehensive, and all of them come too late to be of real help in disease control.

A central statistical organization, prepared to collect and to distribute promptly information pertaining to the incidence and occurrence of the communicable diseases would be a helpful addition to our disease-fighting equipment. Without the intelligence thus made available, we are navigating an uncharted sea and as transmissible diseases of food-producing animals are becoming increasingly important with the increment of population, this association may well take the initiative to bring about the establishment of an organization charged with the collection

of statistical data relating to animal diseases and with the prompt publication of its findings.

The very existence of our organization bears testimony of a new epoch in our civilization, the outstanding feature of which is the look forward. The latter is the foundation of disease prevention, our aim.

While there always will be demand for the handicraft of the veterinary surgeon and for the wisdom of the veterinary physician, we must look to the sanitarian for aid and guidance in the control and suppression of the transmissible diseases which are a real or potential menace to our national food supply and to the prosperity of those who produce it.

PRESIDENT VAN ES: The next number on the program is the report of the Secretary-Treasurer.

. . . Secretary Dyson read his report. . . .

REPORT OF THE SECRETARY-TREASURER

My report this year is conclusive evidence of the fact that this Association has survived the economic disaster encountered several years ago, at which time we were confronted with a deficit, that, for a time at least, caused considerable anxiety on the part of the Secretary-Treasurer. Our financial status at this time, as will be shown by the itemized statement covering my annual report, leaves no room for doubt as to the possibility of the Association's future growth, and coordinating influence in all matters pertaining to live stock and poultry sanitation.

Our economic rejuvenation has been largely due to assistance rendered in a substantial way by forward-looking live stock sanitary officials, who subscribed for state and federal membership, including the Dominion of Canada. On the other hand, however, there are a number of our leading live stock producing states, the live stock sanitary officials of which have not succeeded in securing a state membership. In this connection, I would suggest that "where there is a will there is a way."

About five years ago, when this Association was struggling for economic stability, I endeavored to induce the American Veterinary Medical Association to publish the annual report in lieu of one monthly issue of the JOURNAL. Last year an agreement was reached between Dr. Hoskins and myself, acting under the executive committees of our respective associations, whereby the report of the proceedings of last year's meeting was published by the American Veterinary Medical Association as the March issue of the JOURNAL. This arrangement not only served the purpose of reducing the expenses of the Association, but placed in the hands of every member of the American Veterinary Medical Association a copy of the report, over 5000 copies of which were distributed to the best possible advantage when viewed from the standpoint of promoting live stock and poultry sanitation in which this Association is primarily concerned, and which incidentally applies to the veterinary profession at large.

Great credit is due to our Policy Committee in the matter of drafting the present constitution and by-laws, which have served to place the Association upon a footing where permanence and progress can be assured.

Several years ago we were struggling for new members largely for the sake of the membership fee. Now, however, we want new members largely for the sake of what they can do by way of contributing to present-day knowledge of live stock and poultry sanitation, and its practical application in its proper field.

FINANCIAL STATEMENT

Receipts		Disbursements	
Membership dues		Printing 1926 reports(1200)	$557.52
396 @ $2.00	$ 792.00	Stenographic report	129.75
State memberships		Postage	94.09
29 (see list) @ $25.00	725.00	Printing and stationery	46.85
Reports sold:		Clerical hire	35.00
U. S. Bureau of Animal Industry	150.00	Express	6.20
Canadian Department of Agriculture	50.00	Telegrams	7.09
Fostoria Serum Co.	25.00	Miscellaneous	1.97
Miscellaneous	10.14	Nutritional Committee expense	75.00
Interest on bonds	32.72	Travelling expenses	150.00
Total Receipts	$1784.86	Total Cost of Meeting	$1103.47
1926 Cash Balance	262.14	Investment—Treasury Cert.	806.39
		Cash Balance, December 1, 1927	137.14
	$2047.00		$2047.00

State Memberships

Alabama	Indiana	Mississippi	Ohio
Arkansas	Iowa	Montana	Oklahoma
California	Kansas	Nebraska	Pennsylvania
Colorado	Kentucky	New Hampshire	Texas
Connecticut	Maryland	New Jersey	Vermont
Florida	Michigan	New York	Virginia
Georgia	Minnesota	North Carolina	Utah
		North Dakota	

U. S. Bureau of Animal Industry
Canadian Department of Agriculture

Current Assets—U. S. Treasury Certificates	$2000.00
Cash Balance in Bank	137.14
Total Current Assets	$2137.14
Accrued interest on Treasury Certificates payable December 15, 1927	33.75
	$2170.89

Liabilities—None.

Secretary Dyson (continuing): I am going to ask Dr. C. P. Fitch and Dr. W. J. Butler to enlarge upon some of the statements that I have made in regard to membership.

Dr. C. P. Fitch: I do not believe that it requires any remarks on the part of any individual to show the need on the part of men or other individuals interested in the control of live stock diseases, to aid in carrying on the work of this Association.

There was a time when this Association needed the financial assistance of individuals. From the Treasurer's report, it has been shown that that need has passed, but this Association does need the assistance, the aid and the push that individuals who are interested in live stock sanitation can give it.

The membership of 396 represents but a very small part of the men interested in the control of the diseases of live stock. We need their help. I do not know the best way to go about it to secure their membership in this Association. It certainly cannot be from the financial standpoint, when you stop to consider that the initiation fee and annual dues amount to but two dollars per year.

Personally, I believe that this Association in most instances has not been called to their attention, and if they do know about it, they do not know con-

cerning the work which this Association is doing. Secondly, I believe there is on the part of certain individuals, possibly, an apathy or a general slackness which explains why they have not already joined. They may consider themselves actual members when they are not.

I do not know whether it is best to ask for the appointment of a special committee at this time, but I do believe this group should do something in order to secure additional members for the good of this Association. I thank you. (Applause)

PRESIDENT VAN ES: I can fully substantiate what Dr. Dyson and Dr. Fitch have just said. We find that the hospitality of this organization is extended to anybody interested in live stock sanitation, and I think that policy never should be changed, but I am accustomed to seeing here, in this hall, on the program and on the floor, people who make real contributions to the success of this organization, and I thought they were members of this organization. But last spring, when it became my duty to make selections for the membership of the various committees, I found, to my surprise and my great disappointment, some of the most desirable people for those committees were not members of this organization. I was actually handicapped in making my selections.

Therefore, I would like to see a lot of those folks, with their hearts in the right place, behind this organization, as members instead of as outsiders.

You have heard the report of the Secretary-Treasurer. What is your pleasure?

DR. C. W. FOGLE: I move the adoption of the report.

. . . The motion was seconded, put to a vote and carried. . . .

SECRETARY DYSON: I just want to call the attention of the members of the Association to what it is possible to do by individual effort. We have one outstanding representative of the Association, who, in the matter of securing new members, is in a class by himself—Dr. M. F. Barnes, of Pennsylvania. Dr. Barnes turned in about ten new members during the past year. If there was just a little effort made on the part of a number of our members, we could increase the membership very materially.

PRESIDENT VAN ES: Before we continue with the regular program, I would like to bring to the attention of the assembly that the assistance of this organization has been requested by another organization, for an opinion and for guidance on a resolution which they are about to pass, having to do with the interpretation of certain terms that are current in poultry sanitation, and in the interim I have taken it upon myself to refer that to the Committee on Poultry Diseases. It appears that the other organization is in session at this time and waiting for what this organization has to say on the subject. If I hear no objections to it, I will ask the chairman of the Committee on Poultry Diseases of this organization to report on that one phase at this time, and then later on report other regular findings as a committee. If that meets with your approval, I will call on Dr. W. R. Hinshaw to present that matter at this time, so the other organization can proceed with its business.

DR. HINSHAW: This report is one which was made at the request of several members of the other meeting which is being held. This meeting is a meeting of the poultrymen throughout the United States, who are trying to come to some comprehension regarding the word "accredited."

Last summer the Committee on Poultry Diseases was asked, through your President, to cooperate with the Committee on Unification of Laws and Regulations and report some recommendation regarding the use of the word accredited and accreditation to that group of poultrymen. So the Committee on Poultry Diseases at this time wants to present to the Association the recommendations made to the Committee on Unification of Laws and Regulations.

. . . Dr. Hinshaw read that part of the report of the Committee on Poultry Diseases relative to terminology. . . .

REPORT OF THE COMMITTEE ON POULTRY DISEASES TO THE COMMITTEE ON UNIFICATION OF LAWS AND REGULATIONS

DR. W. R. HINSHAW, *Chairman*, Amherst, Mass.

Dr. R. A. Craig, Lafayette, Ind. Mr. S. S. Knight, Petaluma, Calif.
Dr. Robert Graham, Urbana, Ill. Dr. E. L. Stubbs, Philadelphia, Pa.

During the past two years considerable difficulty has arisen among poultrymen throughout the United States concerning the use of the word, "accredited," in standard breeding plans. Dr. M. A. Jull, Poultry Husbandman, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C., has requested the Committee on Poultry Diseases and the Committee on Unification of Laws and Regulations, through your president, to cooperate in making some specific recommendations so that the National Poultry Conference may be informed as to the Association's attitude regarding the use of the word, "accredited," in poultry-breeding plans.

Your president has requested that the Committee on Poultry Diseases make recommendations to the Committee on Unification of Laws and Regulations, to be acted upon at the thirty-first annual meeting of the Association.

RECOMMENDATIONS REGARDING ACCREDITATION OF FLOCKS FOR FREEDOM FROM DISEASE

Your Committee believes that the control of bacillary white diarrhea and other poultry diseases should be voluntary with the poultry-owner, but that some agency of accreditation, under the supervision of an official public agency, should protect the owner in maintaining a disease-free flock.

The Committee on Poultry Diseases is pleased to make the following recommendations:

1. That the word, "accredited," be used only to indicate freedom from disease;
2. That, when the word, "accredited," is so used, the name of the disease to which reference is made be attached, as in the following examples:

   Accredited Bacillary White Diarrhea Free,
   Accredited Tuberculosis Free;
3. That a flock shall not be accredited as free from any disease until it has passed at least two consecutive negative official tests at intervals of not less than six months nor more than one year apart. Progeny of accredited birds may become accredited after one negative official test. It is understood that in all cases, the word, "flock," indicates 100 per cent of all birds on the farm;
4. That to remain accredited the flock must pass a negative test once yearly. All birds added to an accredited flock must come from other accredited sources and be subjected to an official test before being added to the flock. They must be placed in quarantine until such time as an official test is made and reported;
5. That when it is desirable to indicate that a flock has been tested for a disease before it is eligible for accreditation as being free, it may be listed as such, providing that it be indicated as "tested and reactors removed," and a definite statement is made as to the date of the test, the percentage of reactors, and the number of years of consecutive testing; and,
6. That all official accreditation of flocks be done by the state live stock sanitary boards or other similar official state organizations.

PRESIDENT VAN ES: You have heard this partial report of the Committee on Poultry Diseases. What is your pleasure?

DR. HINSHAW: I move the report be accepted.

. . . The motion was seconded. . . .

DR. C. H. HAYS: The progeny of accredited animals is rather restricted. Not entirely the progeny but the place and condition under which the progeny has been raised, I think, ought to be injected.

DR. HINSHAW: As I understand you, Dr. Hays, you mean in the part where we say, "Progeny of accredited birds may become accredited after one negative official test. It is understood that in all cases, the word, 'flock,' indicates 100 per cent of all birds on the farm." You mean something should be inserted to indicate the care of that farm?

DR. HAYS: The condition under which they are raised.

DR. HINSHAW: Is that not taken care of, provided the flocks are accredited and the official organizations see that there is a yearly test, and that sanitation is taken care of? They could not be accredited unless they have been taken care of on the farm, reactors removed, and so on. I think that has been taken care of by another committee report.

DR. HAYS: I just raised that as a question.

DR. HINSHAW: I see your point but I wondered if that has not been taken care of. If not, we will be glad to incorporate that, of course.

PRESIDENT VAN ES: Are there any further remarks? Are you ready for the question?

. . . The question was put to a vote and carried. . . .

PRESIDENT VAN ES: The next item is the report of the Executive Committee. Dr. Dyson tells me there is no report. As far as this program is concerned, that ends the work for this morning, but we have a little time yet, and there is a heavy program ahead of us. I will call on some of the afternoon speakers, if that is your wish.

DR. N. F. WILLIAMS: If it would meet with the approval of the Chair and the members of this organization, I believe it would be wise to follow the program, because there are members who could not be here at this time, who will be vitally interested in the presentation of the papers scheduled for this afternoon.

DR. R. R. DYKSTRA: I agree with Dr. Williams that it would be better to follow the regular program.

I move we adjourn at this time to meet promptly at one o'clock.

. . . The motion was seconded, put to a vote and carried. The meeting adjourned at 11:50 a. m. . . .

WEDNESDAY AFTERNOON, NOVEMBER 30, 1927

The second session was called to order at 1:15 p. m., by President Van Es.

PRESIDENT VAN ES: The first number on our program is the paper by Dr. Maurice C. Hall, on "Developments in Swine Sanitation." (Applause)

. . . Dr. Hall read his paper. . . .

DEVELOPMENTS IN SWINE SANITATION

By MAURICE C. HALL, *Washington, D. C.*

Chief, Zoological Division, Bureau of Animal Industry, United States Department of Agriculture

The historical background of the work on swine sanitation in the United States can be outlined very briefly. Up to 1915 it had been generally assumed on the available evidence that when the eggs of the large roundworm or ascarid of swine were swallowed by pigs, the eggs hatched in the digestive tract and the worms which issued from the shell developed to adults in the small intestine. In 1915 Stewart published an account of experiments showing that this was not the case and that the young worms migrated to the liver, then to the lungs, and then by way of the windpipe to the mouth, returning from there to the small intes-

tine and developing this time to adults. His work was repeated and enlarged on by various workers, the important work in this country being done by the late Dr. B. H. Ransom, alone and in collaboration with his associates in the Zoological Division. The American investigations developed the fact that young pigs were much more susceptible to the injurious effects of the worms, both as regards the effect of the adult worms on them and as regards the effect of the larval worms in their journey through the lungs.

On the basis of the experimental procedures, Ransom concluded that it would probably be possible to raise young pigs free from ascarids or so lightly infested that they would avoid the bad effects resulting from heavy infestations. The object aimed at was to have the pigs born in a place where infective ascarid eggs were not present, to move them before any ascarid eggs present could become infective, and to place them on a clean pasture away from older animals other than the mother sow that might contaminate the pasture, assuming for practical purposes that on a large pasture the ascarid eggs from the few ascarids the sow might harbor would be so scattered that gross infestation of the young pigs would probably be avoided. The basic idea was to give the young pig the special attention that the young of all animals demand, providing in this case clean farrowing and the separation of the young from older animals carrying infection and from infected areas. Mechanical cleaning was depended on to ensure clean farrowing and light stocking to prevent infection from the sows.

After laying down his plans on this theoretical basis, Dr. Ransom transferred them to the field, to give them the acid test of practical use under farm conditions. This phase of the work was put in charge of Dr. H. B. Raffensperger, and in his initial field investigation he ascertained the highly important fact that the condition known as "thumps" in little pigs on farms was due, in the cases examined, to larval ascarids in the lungs and identical with the condition which could be artificially produced by feeding ascarid eggs to little pigs. This was a finding of great practical importance in the field of pathology.

McLean County Experiments

Field experiments were begun in a small way in 1919, in McLean County, Illinois, and were extended to large-scale experiments carried on through 1925. The results obtained were

surprisingly good. By contrast with the uneven herds ranging from good pigs to runts, which are so often observed where pigs are raised under ordinary hog-lot conditions, the herds raised under the sanitation system were uniform and thrifty, and practically devoid of runts. The farmer raised as many pigs from two sows as he had been raising from three, marketed them a month to six weeks earlier than formerly, and saved the expense of one sow and of feed for the pigs for four to six weeks. Some farmers estimated that the system put an average of $200.00 in the pockets of each of its users annually, and it is probable that the Middle West is benefitting by the use of the system to at least the extent of a million dollars annually at the present time.

Not all of the benefits from the system can be charged to avoiding losses from worms, since sanitation in the sense of cleanliness is as near a panacea for contagious disease in general as we have, and in practice the system was quite effective in preventing or diminishing losses from necrobacillosis, mange and kindred diseases. However, the pathogenicity of worms for young animals was well established in the case of swine, and a large share of the saving was due to preventing the loss from worms which it was designed to prevent. No one could safely undertake to say, without much more detailed experimental data than are available, just what losses are due to worms and what to other things on even one farm, much less on 30 farms or over the United States.

The detailed report on the work in McLean County is being published in a paper by Dr. Raffensperger and his associate, Mr. Connelly, in the *Journal of Agricultural Research*, and members of this Association should secure copies of that paper when it appears, as it probably will at an early date. It contains a large amount of valuable data, from which I take the liberty to present one of the most striking things. By comparison with what occurs in swine herds throughout the United States in the way of a loss of about 45 per cent of the pigs farrowed and the raising to market age of 55 per cent, the sanitation herds show a loss of 23.8 per cent of the pigs farrowed and the raising to market age of 76.2 per cent. In round numbers, the system cut the usual losses in two and increased the number sent to market by 50 per cent.

Poor Breeding, Poor Feeding or Poor Judgment

On first sight you may be inclined to ask: "Why didn't the sanitation system cut the losses to less than 10 per cent and raise

the number marketed to over 90 per cent of the number farrowed?" An inspection of the data showing the causes for the loss of pigs under the sanitation system answers the question. There was a loss of 17.2 per cent of pigs at farrowing time from exposure, overlaying and stillbirths, and a loss of 5.29 per cent on pasture due to accidents, being kicked or trampled by mules or cows, from rape-burn, or similar things. Losses from cholera amounted to 1.5 per cent. In general these things are matters of poor breeding, poor feeding or poor judgment. A sanitation system intended to avoid loss by communicable disease can not supply good breeding, put intelligence in a head that lacks it, or even prevent an intelligent farmer from doing unwise things inadvertently or from lack of sound information. The prevention of cholera calls for something besides sanitation. These losses are due to things which lie outside of the domain of parasitology. The parasitologist has done his work, and great credit attaches to Dr. Ransom and his colleagues in the Washington laboratory, Mr. Foster and Dr. Cram, and to Dr. Raffensperger and Mr. Connelly in the field.

The problem now confronting the swine-grower—how to cut the losses now sustained—is one for the veterinarian, the animal husbandman and the farmer to answer. The importance of the individual farmer in the attainment of results is shown by a consideration of the losses that might in part be charged to defects in the sanitation system of a specific item as a cause of death to which to charge it. The data here show that when the farmers cooperating were classified as excellent, good and fair, according to the measure of cooperation shown and the extent to which the system was carried out, the system was 98.7 per cent effective in protecting the excellent cooperator, 96.64 per cent effective for the good cooperator, and only 93.86 per cent for the fair cooperator. When the system was carried out in detail it gave almost perfect results, but there was a noticeable loss when a man started to "cut corners."

Early in 1926, the work in Illinois was stopped and the swine sanitation project transferred to Moultrie, Georgia, under the direction of Dr. E. M. Nighbert, with the assistance of Mr. Connelly. As that work had to be organized, the actual working project in Georgia is still decidedly less than two years old and it is rather early to be making any claims in regard to it, but the promise of brilliant results is already evident. Because of the special conditions at Moultrie, it is possible to obtain data that

could not be obtained at Bloomington. All swine in that part of the country are slaughtered at Swift's plant in Moultrie and we have our laboratory at their plant through the courtesy of the company and the local manager, Mr. McDowell. Under such conditions we obtain a postmortem examination of swine raised under the sanitation system and of such others as we need for checks. We also obtain data on market prices and weights of animals involved. We have here kidney worms, not present in McLean County, and can ascertain the effect of the system in controlling these parasites. Finally, we have one farm under our immediate direction as regards the raising of its pigs.

Results To Date In Georgia Experiments

Some of the results to date may be briefly given. Junior gilts raised on the farm under our direction were recently shown at the Southwest Georgia Fair, the first time their owner had shown; one was champion in its breed and others won first, second and third prizes. Ten pigs from another farm recently topped the market; they were about six months old and weighed about 200 pounds each. As regards kidney worms, the returns to date indicate that sanitation is controlling these to a marked extent. A recent report by Dr. Nighbert and Mr. Connelly shows that in some hundreds of pigs less than one year old, including those raised under the swine sanitation system, and those raised under ordinary conditions, only 4 per cent of the sanitation pigs had kidney worms, while 16 per cent of the other pigs, or four times as many, had kidney worms. In the first year's work, the large number of normal livers in these swine was a matter of great interest to the packing-house employes who were accustomed to seeing such livers only rarely. This year, for some reason, there have been quite a number of abnormal livers unaccompanied by kidney worms, in sanitation swine. The reason for this is not known, but the experiment is still young. We shall learn more about this later.

A statistical study of condemnations of parts of swine carcasses for parasitism in the course of one week at Moultrie shows the following: Swine killed, 5,308; total condemnations (livers, kidneys, kidney fat, sweetbreads and casings) for parasites, weight, 19,406 pounds; gross value of this material, $1584.95; tankage credit, $81.15; net loss, $1503.80; average loss per head, 28⅓ cents. This loss is quite aside from losses by death, stunting, wasted feed, etc. It is a perfectly tangible loss directly charge-

able to parasites, and apparently we are going to prevent a large part of this loss by means of sanitation.

It is too early to give statistical returns on pigs farrowed, turned to pasture, and sent to market, but it is worth noting that the farmers cooperating are satisfied and that local bankers prefer to lend money to farmers for the purchase of pigs if they are handled under the sanitation system. The present indications are that in the South the swine sanitation system will do all that it has done in the Middle West, and perhaps more, since it will have more to do in preventing the loss now sustained from kidney worms.

PRESIDENT VAN ES: You will observe that the discussion of the papers is put off until the end of the program of the session to which they belong, so we can proceed to the next paper, on "Swine Dysentry—Some Sanitary Considerations," by Dr. R. A. Whiting.

. . . Dr. Whiting read the paper. . . . (Applause)

SWINE DYSENTERY

By R. A. WHITING

Purdue University, Lafayette, Ind.

Ten years ago there was recognized in Indiana what proved to be a new infectious disease of swine. At least, we found no description of the disease in veterinary literature. The early outbreaks occurred in feeding hogs that were shipped from the Chicago stockyards; later outbreaks occurred in breeding and feeding hogs through contact of the breeding herds with the diseased hogs, and through the purchase of feeder hogs in local stockyards and sale pavilions. In 1926, more than twenty outbreaks in feeding hogs that were shipped from points in the Northwest, the South St. Paul stockyards, Aberdeen and Mitchell, South Dakota, were reported by Dr. F. H. Brown. His field diagnoses were confirmed by the Veterinary Department by feeding cholera-immune hogs the colons and contents of colons from hogs which died of the disease or were killed while showing well-marked symptoms. Altogether, during the past year, thirty or more outbreaks were diagnosed.

Stockmen soon recognized this condition as a distinct disease and named it "bloody diarrhea." It has been diagnosed by veterinarians, as "serum breaks," "mixed infection," "necrotic enteritis," "necro," and "infectious enteritis" or "colitis." These names refer to the prominent symptoms or lesions that occur in the disease.

The early symptoms are moderate fever, diminished appetite, and slowness, usually followed by a profuse bloody diarrhea. The diarrheal discharge is characterized by the presence of mucus, shreds of tissue, and blood. In the latter stages of the disease the hog is usually weak and emaciated. The course of the disease varies from a few days to a few weeks. If death occurs early, the carcass is usually well nourished. In the later stages, marked emaciation is noted. The chronic cases are more numerous in young hogs or pigs; cases that recover from the disease may be unthrifty and stunted.

The death-rate varies from 40 to 60 per cent in young hogs; from 20 to 30 per cent in feeding hogs, and from 5 to 10 per cent in breeding hogs. The death-rate in feeding hogs may run as high as 90 per cent.

Upon postmortem examination the changes which characterize the disease are found in the colon and may also be found in the stomach, cecum and rectum. A marked gastritis is very common. The small intestine rarely shows lesions. During an early stage of dysentery the colon mucosa is swollen and hemorrhagic and the colon contents contain a great deal of mucus and blood. A little later, diphtheric plaques form on the colon mucosa. These plaques become loosened and mixed with the colon contents so as to give a peculiar granular or mealy appearance. In still later stages, there is extensive necrosis of the colon mucosa. The stomach mucosa shows pronounced hyperemia and hemorrhages; it may also show necrosis the same as the colon.

Microscopical sections of the colon taken early in the disease show an exudate consisting of mucus, fibrin, bacteria, protozoa, lymphoid cells, polynuclear leucocytes, desquamated epithelium and red blood-cells. The blood- and lymph-vessels of the mucosa are engorged and there is considerable extravasation of blood. The epithelium may be gone or pushed away by extravasated blood. The epithelium of the crypts shows an adundant production of mucus. Occasionally, the submucosa is edematous and hemorrhagic.

Sections of the colon from a later stage of the disease show a well-marked catarrhal inflammation. The colon epithelium may be nearly all gone and the mucosa is covered with a diphtheric exudate. The crypts are distended with mucus and the epithelium of the crypts is atrophied. Sections of the colon from still later stages of the disease show necrosis extending inward to varying depths. Thrombosis of the blood-vessels in the mucosa

FIG. 1. Early stage of dysentery showing hyperemia and hemorrhagic exudate of colon mucosa. Hemorrhage is breaking through epithelium.

and submucosa may be noted. Because of the symptomatology and pathology of this disease we have named it dysentery.

Early investigations of field outbreaks showed that the blood of sick or dead hogs did not produce the disease. In order to test the infectiousness of blood, thirteen pigs were fed or infected intramuscularly with fresh blood from acute cases of dystentery. The pigs remained well for twenty-one days. Part of these pigs were then inoculated with hog cholera virus and proved to be susceptible to hog cholera. The balance of the pigs were then exposed to dysentery. All of them developed the disease and later, when seven had fully recovered, they were inoculated with hog cholera blood and died. The same results were obtained when hogs that had recovered from natural field outbreaks of

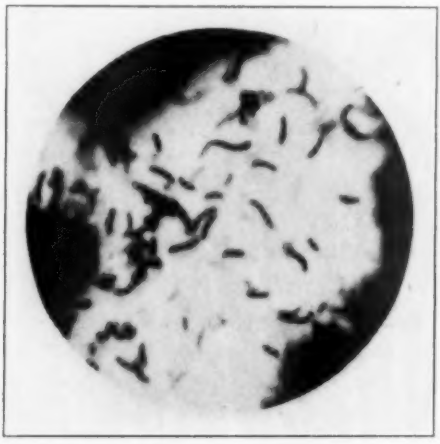

FIG. 2. Vibrios which occur commonly in the colons of dysentery pigs.

dysentery were given pen exposure to cholera hogs. These experiments, and others which were performed later, show that dysentery is a disease entirely distinct from hog cholera.

Early attempts to isolate the specific organism of dysentery, by bacteriological examinations of twenty-three carcasses, resulted in the isolation of *Bacillus suipestifer* from sixteen. Bacteriological examinations of the carcasses of a large number of other dysentery pigs showed that this group of twenty-three pigs was exceptional so far as the occurrence of *B. suipestifer* was concerned. It was found that the occurrence of this microorganism in dysentery varies in much the same way as it does in hog cholera, that is, it may be easily demonstrated in the carcasses of a large pro-

portion of certain groups of sick hogs, while in other groups it can not be found.

Several of the strains of *B. suipestifer* were tested for pathogenicity by feeding them to pigs. Some strains were found to have marked pathogenic properties. The feeding of doses, not exceeding 50 cc of 24-hour broth cultures, of some strains produced fatal illness in pigs, characterized by loss of appetite, fever and diarrhea. In one series of experiments, cultures of *B. suipestifer* were fed to fifty-seven pigs. Thirty of the pigs became sick and five died, while twenty-seven remained well.

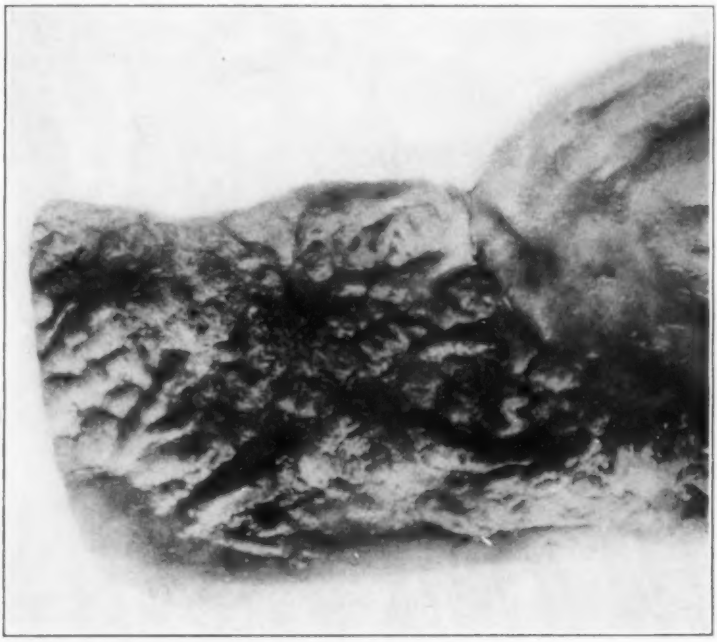

FIG. 3. Colon mucosa showing necrosis and diphtheric plaques.

The diarrhea shown by these pigs was never bloody, and did not contain recognizable amounts of mucus. Although the pigs that died from feeding the *B. suipestifer* cultures showed considerable necrosis of the stomach and small intestine and in some cases of the colon, the lesions did not otherwise resemble those of dysentery.

In order to determine whether the pigs that had recovered from *B. suipestifer* infection possessed immunity to dysentery, forty of them were exposed to dysentery by being placed in pens with

FIG. 4. Late stage of dysentery showing atrophy of epithelium and diphtheric exudate of superficial portion of colon mucosa.

dysentery hogs. Thirty-six developed dysentery and six died. Two pigs that recovered from dysentery were fed cultures of *B. suipestifer*. Both became sick and one died. Intravenous injections of *B. suipestifer* did not produce symptoms that were suggestive of dysentery. Eight of these pigs were exposed to dysentery, six developed the disease and two died. Four pigs that received from 5 to 10 cc intramuscularly remained well. Upon exposure to dysentery, all four developed the disease and two died.

Blood-serum of more than 100 dysentery hogs was tested for *B. suipestifer* agglutinins. The blood was collected at different periods during the disease and after recovery. The results of these tests showed that less than 30 per cent of the dysentery hogs possessed agglutinins for *B. suipestifer*. The majority of the pigs which gave positive results were former serum- and virus-test pigs. Practically all blood samples from hogs that had recovered from natural field outbreaks of dysentery failed to show any agglutinins for *B. suipestifer*. It has been our experience that if a pig is actually infected by *B. suipestifer*, its blood serum will contain agglutinins for this microorganism. The agglutinins appear as early as the fourth day after the pig has been infected by feeding, and remain for some time after apparent recovery.

The following experiment was made in an effort to determine the location of the causative agent of dysentery within the body of affected animals.

Eight pigs were fed the fresh hearts, lungs, livers, spleens and kidneys of hogs from three outbreaks of dysentery. (The livers and spleens of some of these cases were known to contain enormous numbers of *B. suipestifer*). The eight pigs all remained well. Pieces of stomach and colon from the same dysentery hogs were fed to other pigs and produced dysentery. In all, thirteen pigs were fed sections of stomach from three field outbreaks; nine pigs developed dysentery and four remained well. Sections of colon from fourteen outbreaks of dysentery were fed to thirty-six pigs; twenty-seven pigs developed the disease and nine remained well. Feces from twelve suspected outbreaks were fed to twelve pigs; eight developed dysentery and four remaiued well. All of the pigs that remained well after the different feedings were exposed to dysentery pigs and proved to be susceptible.

In order to determine whether a filtrable virus was present, colon contents of several hogs showing acute dysentery were filtered by vacuum through large Berkefeld (No. 8) and Pasteur

filters. The Berkefeld filtrates were fed to thirty-six pigs. Five pigs developed dysentery, two died and thirty-one remained well. The Pasteur filtrates were fed to six pigs which remained well. All of the pigs that remained well were later proved to be susceptible to dysentery.

These experiments showed that the cause of dysentery is usually present in the stomach, colon and feces. Consequently, all subsequent bacteriological studies dealt with material from these sources. We have observed one type of microorganism to be at least common and conspicuous in sections of the colon and smears of dysentery feces. We have not been able to cultivate this microorganism in pure culture or determine its pathogenic properties. However, it has been present more consistently than any other microorganism, and was not found in the colons of more than one hundred normal pigs and hogs. These bacteriological studies will be continued with the hope that the causative agent of this disease will be isolated, and that more effective measures for the control of the disease may be recommended.

PRESIDENT VAN ES: The next item on the program is entitled "Transmission of Hog Cholera by Means of Feeder Hogs," by Dr. H. A. Wilson, of Jefferson City, Missouri. Is Dr. Wilson here? It does not seem that he is here. Hence, I will call for the report of the Committee on Diseases of Swine. Dr. R. R. Birch.

. . . Dr. Birch read the report. . . .

REPORT OF COMMITTEE ON SWINE DISEASES

DR. R. R. BIRCH, *Chairman*, Ithaca, N. Y.

Dr. H. J. Shore, Fort Dodge, Iowa Dr. F. H. Brown, Indianapolis, Ind.
Dr. C. H. Stange, Ames, Iowa

There have been no unusual features connected with the swine disease situation during the year. The rather high prevalence of hog cholera in 1926 has not continued in 1927. Hog "flu" has proved very destructive, and while there are no statistical data at hand, most observers believe it has been increasing steadily. Parasitic diseases, necrotic enteritis, and various maladies of the young pig have, as always, taken a heavy toll, and it is gradually becoming evident that these diseases, disastrous in themselves, also are a retarding influence in effective immunization against hog cholera.

HOG CHOLERA

Study of the hog cholera curve from 1887 to 1927 brings out two essential facts:

First, the curve is favorably influenced by vaccination as it has been practiced.

Second, vaccination has not been made to govern this curve in a satisfactory manner.

Your Committee believes that for a long time to come vaccination must play an important part in the handling of hog cholera, but that vaccination alone, effective though it is in the majority of herds treated, is not the sole solution of the hog cholera problem. Nor is the mere extension of vaccination, the only, or the most important, consideration.

If every hog in the United States were to be vaccinated the losses from cholera could scarcely be expected to fall below 2 per cent (20 per 1000). If the cost for serum and veterinary fees averaged 50 cents per head the loss to the swine industry, valuing hogs at $18.00 per head, would be the equivalent of one in 36 (28 per 1000); in all, 48 per 1000. The actual average annual losses during the last decade were 47 per 1000 plus costs of immunization. Thus it is evident that universal vaccination might distribute the loss, but would not prevent it.

Your Committee believes that some herds require vaccination, others do not; that herds needlessly or improperly vaccinated are a menace to others in the vicinity; that herds definitely threatened require prompt and effective vaccination and that judicious selection and careful vaccination and segregation of herds definitely threatened are all-important measures.

Your Committee recommends that sanitary measures to prevent the spread of hog cholera shall be directed at the principal causes known to be responsible for primary outbreaks. These include: the shipping of susceptible feeder hogs, or those but recently vaccinated; the shipping or movement of infected animals; unsupervised feeding of garbage in large or small quantities; improper or inopportune use of serum-virus immunization.

In the furtherance of this program your Committee particularly recommends:

1. That the feeder should be encouraged to raise his own swine, or to purchase just as far as possible from immune herds.
2. That hog cholera shall be made a reportable disease in the several states.
3. That all possible efforts shall be made to avoid public stockyards in the transportation of hogs not intended for immediate slaughter.
4. That more severe penalties, in the way of condemnations, shall be placed on consignments of hogs which reach stockyards visibly infected with hog cholera.
5. That the change in policy regarding condemnations be given publicity in advance.
6. That the various state sanitary boards take measures looking towards licensing and supervision of garbage-feeding plants and rendering plants and the prevention of desultory feeding of collected city garbage.
7. That the dangers involved in feeding even the home supply of kitchen refuse be brought before swine-growers at every opportunity.
8. That serum-virus treatment of hogs should be practiced only by competent veterinarians.
9. That the various state sanitary boards and state veterinary societies shall encourage reporting of excessive charges, or negligence, incident to vaccination.

Recognizing that in the end the lion's share of hog cholera control work must fall on the licensed veterinary practitioner, we recommend to him:

1. The careful education of his clients regarding the manner in which hog cholera spreads.
2. The judicious selection of the herds in his vicinity which require immunization.
3. Careful examination of all herds before vaccination, and the avoidance or postponement of serum-virus vaccination in the presence of devitalizing influences.
4. Great care in the technic of vaccination, and in the storing and handling of serum and virus; ample doses of both products and strict avoidance of the use of outdated material.
5. Due attention to the care of the herd subsequent to vaccination.

To those actually engaged in raising swine we recommend:

1. Segregation of the herd so far as is possible, foregoing all unnecessary purchases.
2. Employment of a method of controlling parasites, such as the McLean County System, as outlined by the Bureau of Animal Industry.

3. Herd breeding and management to prevent some of the subvirulent infections, and enhance successful immunization where immunization is necessary.

4. Systematic year-to-year immunization of the season's crop of pigs in herds threatened with hog cholera; in herds not regularly immunized, careful observation and prompt reporting of disease to the local veterinarians.

5. Avoidance of cut-rate vaccination as applied either to the products used or to the one who uses them.

Your Committee regards it as possible that the use of serum more than two years old or virus more than sixty days old may be contributing factors in post-vaccination cholera. It therefore recommends careful observation of the outdating on the labels of both products; and especially does it recommend investigation of all branch distributing centers, as regards storage facilities and handling.

Other Diseases

Your Committee commends the researches on necrotic enteritis and swine dysentery which have been conducted at the Iowa State College and Purdue University and recommends that work of this character shall be continued. It also directs attention to the lack of definite knowledge regarding the cause and prevention of hog "flu," and urges that institutions having the opportunity study this disease more thoroughly.

Dr. Birch: Mr. President, I move the adoption of the report.

. . . The motion was regularly seconded. . . .

President Van Es: It has been moved and seconded that the report of the Committee on Swine Diseases be adopted. Are there any remarks?

Dr. Clark H. Hays: Speaking from Nebraska, I think it would be a serious mistake for this Association to go on record to discourage systematic immunization of swine. We are not getting enough swine herds vaccinated for hog cholera. We can measurably control hog cholera by a more liberal vaccination of swine. I voice objection from Nebraska on that part of the report.

Dr. Birch: Mr. Chairman, I am very sorry if this report gave the impression that the Committee does not believe in vaccination. The Committee thought well to show that even if we followed vaccination, as we might say, to its bitter end, we would be just about where we started. We laid particular stress on the fact that herds which are definitely threatened should be vaccinated, and that they should be vaccinated by men who know how to vaccinate them, and with products which are the best that can be obtained.

The spread of hog cholera through vaccination has occurred in places where this has not been observed. There is no one capable of deciding which herd is threatened. There is no one more capable than the practicing veterinarian in that community, and just the old slogan, "Vaccinate or lose," is not going to get us anywhere. We must take measures which will prevent the spread of hog cholera to some extent, and we must vaccinate those which require vaccination, and we must vaccinate them well. We are not talking against good vaccination. There is nothing in the report to indicate that.

Dr. A. W. Miller: I understood a recommendation there to avoid large markets in the shipment of feeder or stocker hogs. Is that right?

Dr. Birch: Yes.

Dr. Miller: Why?

Dr. Birch: Because the hogs are more regularly infected.

Dr. Miller: I do not believe I have understood your recommendation properly. I understood in the movement of a shipment of feeder and stocker pigs, you recommend they avoid the large markets.

Dr. Birch: Avoid large markets with hogs which are not intended for immediate slaughter.

Dr. Miller: Let me make a little statement. The large public stockyards are under federal supervision. If a shipment of feeder and stocker hogs comes along, they are not permitted to be unloaded except in clean, disinfected

pens, set aside in some isolated section of the yard, for that purpose. There are hundreds of other yards, not markets, where these same feeder and stocker hogs are unloaded, that have not been cleaned and disinfected, possibly, since the last outbreak of foot-and-mouth disease. I still ask the question: Why?

DR. BIRCH: We could avoid all of them to very good advantage. The history of the hogs that go out of the large stockyards does not lead us to believe that the protection is what it should be. That is the reason.

DR. MILLER: I do not believe I have made myself clear yet. I am not speaking of hogs in the public stockyards. I understood your recommendation was for hogs shipped from one country point to another country point, and you recommended they avoid the public stockyards.

DR. BIRCH: Just as far as possible, yes.

DR. MILLER: I will agree it would be a good idea if they did not go into any yard, but I would not recommend they avoid the public stockyards and unload in some small yard.

DR. BIRCH: Mr. President, the Committee has no such thought as that. I am very glad you brought the point up, and we will be glad to say stockyards; that is, the hogs should be carted as far as possible, and they should not be unloaded in any public stockyards. If the other members of the Committee will accept that revision, I will be very glad to do so.

DR. J. W. CONNAWAY: This report was presented a little prematurely. I see that Dr. Wilson is here and has a paper that may throw a lot of light on this very problem that we are discussing. I would move, if it is in order, that the adoption of this report be deferred until after the reading of Dr. Wilson's paper, if that meets with the approval of the Chairman.

PRESIDENT VAN ES: I would declare it to be in order with the consent of Dr. Birch and his second. If so, we will call for Dr. Wilson's paper on "Transmission of Hog Cholera by Means of Feeder Hogs."

DR. H. A. WILSON: Mr. Chairman and Members of the Association: Some two years ago I made a little talk before the Association, and I was so badly misquoted on some literary terms that I attempted to use, that this time I wrote it down in black and white. I have made absolutely no allusion whatever to any authors or any literary masterpieces, past, present or future. (Laughter)

. . . Dr. Wilson read his paper. . . . (Applause)

TRANSMISSION OF HOG CHOLERA BY MEANS OF FEEDER HOGS

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By the term, "feeder hog," or "stock hog," we mean a hog weighing from eighty to as high as 150 pounds, the ideal type not exceeding 110 to 120 pounds, ready to be placed in the feed-lot or to follow cattle and act in the capacity of scavenger. The supply of this type of hog is obtained from various sources. Wooded countries which are hilly and rough in nature, such as are found in southern Missouri and northern Arkansas, supply a considerable portion of feeder hogs in the middle western states. Then we have the semi-arid countries, where dry farming is practiced, and which, under favored conditions, are able to send their hogs to market in killing condition, but when adversity occurs, in the way of lack of rain-fall and its resulting crop failure,

are forced to market what in daily parlance might be termed "a half-grown hog." This last-mentioned type of hog is perhaps the best and most profitable type of feeder hog obtainable to the Corn Belt farmer.

The mast-fed hog in a great many ways is anything but desirable. He is inbred, lowbred, unthrifty and heavily infested with parasites. He is a "low brow" by nature and an outlaw from training and choice, and nothing more nor less than a gripe to the unfortunate who buys him with the expectation of filling out his hollow sides, covering his numerous projections, and rounding out his long legs to make a smooth-finished, marketable, satisfactory hog out of him.

The next source of supply is the light pigs and hogs sorted in the large public stockyards, which are too light for killing purposes but which section D, regulation 6, of B. A. I. Order 292, permits to be temperatured and anything exhibiting a temperature of less than 104° F. to be inoculated under the supervision of a B. A. I. inspector and, after a thorough disinfection, to be transported out of those yards and into the various states in conformity with the regulations of the state of destination.

Everyone conversant with the shipping of live stock under rural conditions in the Middle West knows that a great many men, when they find that they have diseased hogs upon their premises, will resort to the practice of loading everything on the place—old and young—into a car and consign the shipment to a public market. It is from this kind of shipments that a large percentage of the feeder hogs obtainable at the public stockyards are procured. It appeals to me that the weak point in the federal regulations pertaining to that particular phase of live stock disease control lies in the fact that any hog which comes from a carload of hogs, any of which were found affected with cholera on arrival in the yards, may be permitted to be inspected, inoculated, disinfected and returned to some other community. The particular hog in question might be upon the verge of breaking with hog cholera at time of examination but yet would show no elevation of temperature and needless to say no apparent symptoms of sickness. I firmly believe that only such hogs as come from shipments which were found to be absolutely free from any disease whatsoever should be permitted to enter the stock hog division of the public stockyards, to be inspected, treated and resold to a feeder.

Perhaps you will say that this sort of a case represents only a small percentage of the total number of stock hogs inspected and immunized in the large concentration centers. Furthermore, I perhaps would willingly agree with you that of the thousands of hogs shipped to the public stockyards from Missouri points annually, you would find but very few reports from the inspector-in-charge to the effect that so-and-so shipped a bunch of cholera-infected hogs to that particular market. Nevertheless, we do know that the buyers of these hogs report that their losses begin to occur from the second or third day and continue throughout and including the twenty-first to the thirtieth day after shipment of the hogs in question. In the cases of hogs breaking around three to six days after treatment, it is evident that there must have been something wrong with the hogs at the time of treatment. Otherwise, they would not have broken so soon.

The same rule applies to hogs shipped from country points and vaccinated before shipment by an authorized veterinarian. The records compiled by this office, for a period of eight years, will show that there is very little variation between the death-rate of hogs which come from public stockyards, inspected and vaccinated before shipment by a Bureau inspector, as between hogs which have originated from rural points and been shipped to rural points in Missouri. Furthermore, the loss of hogs vaccinated before shipment at rural points does not vary to any extent as compared with the loss upon hogs moved on special permit from the office and vaccinated at destination by a local authorized veterinarian. Take it all in all, the losses average in the neighborhood of approximately five per cent, irrespective of the point of origin and type of inspection they underwent at time of shipment. The great trouble is that some fellows lose ninety-nine per cent and others lose no per cent at all, thus, you see, making it very hard on a few individuals.

I have merely dwelt in this preliminary manner in order that the listener, if he does not happen to be informed upon the system that is used, might be in a better position to appreciate fully the problems of the feeder-hog business and its relation to the general well-being of the hogs raised and fed in the communities to which the feeder hog is imported. As compared with the total number of hogs produced in the state of Missouri, for example, the feeder hog is an insignificant quantity. Missouri breeds approximately 3,000,000 hogs annually. The average normal movement of feeder hogs from one point to another point

within the State and hogs moved from outside of the State into the State is approximately 100,000 annually.

If you were to sit down and meditate on the matter and consider the source of the hog supply, taking into due consideration all of the dangers and the possible avenues of infection with which the shipment might come into contact, you could readily see that for safety's sake it would be much better to knock each and every one of them in the head, pile them up, and burn them before shipment. Theoretically, it can be readily seen that one load of feeder hogs could easily start a serious outbreak of hog cholera in a community that would wipe out thousands and thousands of head of valuable native hogs. However, we cannot subsist alone on theories in this world, but have to resort to practical things in order to eat. Instead of the feeder hog being a potent source of hog cholera infection, it is my personal opinion that he bears only a very small and insignificant relation to the enormous losses from hog cholera suffered by the Corn Belt farmers annually.

Most feeders who buy stock hogs, regardless of the source from which they purchase them, reside in communities where many other men are engaged in the same line of work as themselves and where few pigs are raised by the feeders. In other words, most of them are brought into feeding communities—communities where annual vaccination is the rule and not the exception.

When I was following practice as a livelihood, I resided in a cattle- and hog-feeding community. I had a number of clients who fed thousands of head of hogs annually. In the year 1915, I vaccinated approximately 5,000 head of imported stock hogs for one firm, with a loss averaging around two per cent. These hogs did not come in one shipment, of course, but were scattered over a period of about seven months. In all that time, I cannot recall a single outbreak of cholera which occurred from the importation of any of those hogs. A few carloads went bad and some losses were suffered. The affected animals showed all clinical symptoms and postmortem lesions of hog cholera. The only reason that outbreaks of cholera were not suffered in the community was because pig immunization was regularly practiced for many miles each way from the particular tract of land upon which these hogs were being fed. As to what might have happened in a community where vaccination was not practiced needs no comment.

The point I wish to drive home in connectiom with feeder hogs in the state of Missouri is that with few exceptions they are brought into communities whose hog populations are protected by vaccination. As to whether or not this same condition prevails in other states, I cannot say, but I venture the opinion that such is the case. Judging from the health certificates we see coming into the office, hogs moved from southern points of Missouri into other states are shipments which go to Iowa, Illinois and Indiana, therefore, I judge, going into communities very similar to the community in which I formerly practiced.

I am not denying the fact that a shipment of feeder hogs, if they do badly, could be a most potent source of serious hog cholera outbreaks, especially if they were to go to a community where vaccination is not practiced and where most of the hogs raised never leave the premises of the owners until they are fat and are being sent to market. I believe that such communities receive a very small share of the total number of feeder hogs transported in the United States annually.

Our records bear out my statements. The reports which we receive from hog-owners and authorized veterinarians, with the exception of a very occasional one, show that no outbreaks of cholera have been started in the community as a result of the particular shipment reported. These reports are received after the twenty-first day. Of course, these reports, like all other forms of statistics, are inaccurate, for the simple reason that if the average farmer were to buy a load of stock hogs on the market, in Kansas City or St. Louis, and a dozen of his neighbor's hogs contracted hog cholera as a result thereof, he would be the last man on earth to report it and he would naturally answer in the negative. The same would be true with the practicing veterinarian, whose clients were shipping in hogs to be inspected and vaccinated by him. Nevertheless, judging from the communities of Missouri with which I am familiar, I consider that, in the majority of cases, those men are telling the truth and that no outbreaks of hog cholera really occurred as a result of the shipments in question.

It is plain to be seen, from the tone of my paper, that I have defended the feeder hog and have attempted to prove him innocent as an important factor in the distribution of hog cholera, as that is the basis upon which we are trying him. However, in other ways he is guilty and as guilty as any culprit ever sentenced at the bar of justice. There is no doubt in my mind but that he

is one of the greatest distributors of parasites we have today. He has broadcast various infections upon the farms of the Middle West, which have literally put good hog-raisers out of business and rendered their premises unfit for the raising of hogs for years to come. Especially, in the case of men who are not regular feeders, but buy a load occasionally when conditions appear good. That is why that in every case I advise every purchaser of feeding hogs to keep them out of the lots and pastures in which he is raising his annual pig crop.

From the standpoint of cholera, although I do not say he is entirely innocent, I do say that he has been blamed too much and that he has not distributed a one-thousandth part of cholera that has been laid at his door. As compared with the promiscuous and inexcusable distribution of virulent hog cholera virus through county agents, vocational agricultural teachers, commercial serum manufacturers, serum jobbers and other agents which are working hand in hand, and traveling side by side in the distribution of hog cholera virus and placing it into the hands of untrained laymen, the feeder hog is smaller in comparison than a gnat's nostril to the Mammoth Cave in Kentucky.

PRESIDENT VAN ES: Gentlemen, the subject of swine diseases is open for discussion.

DR. MILLER: I would like to make a short remark on this paper. I am thoroughly in accord with the sentiments Dr. Wilson expressed in this paper, but there were one or two references to our regulations that he made, that, if I understood him correctly, were not exactly in accordance with the facts. I am going to give my understanding of what he stated in regard to temperature. That was, if the animals exhibited temperatures of 104° F. or less, they would be immunized, even though they came from a cholera lot. The regulation states that a lot which contains cholera is not to be immunized under any condition, for immediate shipment. It contains a provision that a cholera-infected lot must be held in the yards for at least twenty-one days after immunization, so I think our regulation is strictly in accord with the suggestion that Dr. Wilson made. Is that not a fact?

DR. WILSON: I do not know. I am a man of very poor education, but I read those regulations when I wrote that piece. I will admit I am somewhat of a dumb-bell, but I thought I had it right. (Laughter)

DR. MILLER: I can't agree with Dr. Wilson on his estimation of himself. I think Dr. Wilson is very keen, but I believe if you will look at regulation 6 again, you will see that there is a particular provision in there, applicable to a cholera-infected lot, and they are all rejected, even though our men can diagnose cholera in only one animal in the lot. They can be immunized and held in the yards until the period you have indicated has expired. Then the hogs, apparently in good health, can go on. I still hold you and I have the same view on the situation.

DR. WILSON: I would like to ask one question in that connection. When a load of hogs comes into the yard that contains, say, a large number, or any number of light shotes, are all those lots inspected before the shotes are permitted to be taken out and yarded in the stock pig division?

DR. MILLER: I do not belive I could say they are. Theoretically, they are supposed to be. You are familiar with stockyard conditions, and you know that when 55,000 hogs landed here in Chicago yesterday, our men probably

did not see every load before there was some sorting accomplished. They patrol the hog yards as soon as it is daylight; the men on the chutes inspect every load. I do not want to convey the impression that our men never miss a cholera hog.

DR. WILSON: I certainly do not want to convey the impression that I am criticizing the federal government in the way of handling the stock-hog situation. I aimed to admit that the number of hogs shipped from Missouri into public markets, of which we get a report, that were infected with cholera at time of arrival in the yards, is practically nothing. Of course last fall it ran pretty regularly. We would get two or three a day. Ordinarily we sometimes go three months and never get such a report. Evidently the Missourians are not shipping any, or many, cholera hogs to the yard. They may come from other states.

I think the number of hogs, Doctor, that would come out of the cholera bunch, would be very small, and I want to repeat I think the way the government supervision of this thing is being handled is just as perfect as it could be, notwithstanding our records do show there is very little difference between the hogs shipped from rural points, notwithstanding some come from the most filthy conditions you could imagine, as compared with those that come from public yards.

DR. F. H. BROWN: May I ask Dr. Miller a question. Isn't it true that your regulation states that if 20 per cent of the consignment of hogs that come before your men for vaccination show an elevation of temperature, the whole lot is turned back, and cannot be vaccinated and shipped to the farms before the expiration of 21 days?

DR. MILLER: That is an instruction. It is 15 per cent. It is not in the regulation. I think Dr. Wilson was discussing only the regulation. We have some instructions to supplement the regulation, and there is a provision in there that if more than 15 per cent of the animals show temperatures of 104° F., or over, they cannot be immunized that day. They can be withdrawn, and if the order buyer so elects, he can present them the next day. Sometimes the temperatures will be down and we pass them, but not if there is cholera. If there is cholera the first day, they are turned down, subject to immunization and being held in the yards. I am going to have the regulation here, Doctor, to go over with you on that particular provision some time today.

DR. W. J. EMBREE: Just a little information that might be of interest During the year 1926 there were 425,995 hogs shipped out of the large markets, handled under the supervision of the B. A. I. The railroads have all the large losses that take place in transit. Out of that large number of hogs, I know at the present time of only about eight claims on large losses in transit. In comparison with that, we had during the first few months of this year something like $50,000 worth of claims to look over in connection with hogs that were shipped from points, other than large markets, to country points.

Just a thought in connection with the vaccination of hogs as it is being carried on now by the B. A. I. St. Paul furnished 179,800 of those hogs; Kansas City, 96,000; St. Louis, 26,000; other markets not reporting. That is just a matter of information.

DR. BIRCH: In order to get more information, I would like to ask if in case these hogs were to die after they reached the farm, say, in three or four weeks, would the railroad get any report on those hogs?

DR. EMBREE: That happens to be the usual source of a large claim. In very few of the large claims are there very many dead in the car, sometimes eight or ten. The large claim is usually built up on the outcome of the load after it reaches destination, by attaching the results of the shipment to something that happened in transit. For instance, on loads moving from South Dakota to points in southeastern Illinois, a movement that would require about four days under ordinary transportation, if the shipment took four and one-half days to get there, they would attach that half-day's delay to the fact that 98 per cent of the hogs died. At the same time, shipments moving from the same point to Indiana and Ohio points, that required six days for transportation, would go through under good conditions.

We have developed some interesting things in connection with the length of time in transit compared with the amount of death loss, and we would

have to say that stock hogs should not be shipped very far. Possibly they can be unloaded or fed once in the car and in transit with pretty good results. But when they unload two or three times and feed two or three times in the car, they are generally in a deplorable condition.

DR. BIRCH: You would say, then, that the hogs sorted out in the stockyards and shipped, say 1000 miles, would be just as likely to carry through without a claim as those that were shipped the same distance coming from another point?

DR. EMBREE: In fact the information which we have collected seems to be in favor of the stockyards hog. I do not think that the cause of that is that the stockyards hog is in any better or any worse condition than the hog that comes from the country point, but it is largely due to the method in which many of them are sorted. Many times hogs that are shipped from country points are held too long in the collection pens, before they are sold and before there is any attempt to handle them. I think that is one very potent factor. Another thing in connection with your country-point shipment is that there are no facilities at hand for the salvaging of rejects. A man has 180 hogs at a shipping-point, eight or ten miles from home. He cannot do anything with the hog that does not seem to be in the pink of condition. Therefore, the easiest thing to do is to let him go along with the load. At the large market there is means at hand to salvage that animal, and there is no reason why it should be vaccinated. I think that is one very important factor in connection with your country-point shipment.

DR. WILSON: I would like to say a few more words relative to the difference between the country-shipment hogs and stockyards hogs. There is a difference, and it is this: a lot of these country shipments are those hogs with the projections I spoke about. They are a walking zoo. They represent every form of external and internal parasite known to God Almighty and man. (Laughter)

You cannot expect a hog that is allowed to put in his time feeding on a bunch of worms, chasing up and down over the rocks, racing acorns down hill and raising up boulders for his friend to reach in under after worms, to compete with a hog reared on a farm in Illinois, Indiana or Missouri, much less out in Colorado or Kansas or up in the Dakotas, because, to begin with, the hog that has been reared under farm conditions and fed, has a constitution; the other hog hasn't.

In the second place, the hog reared under normal farm conditions in the middle western states has some breeding back of him. This other thing looks as if somewhere in the past there had been most promiscuous social relations between hogs, guinea hens and 'possums. (Laughter) I will explain that. I have seen hogs come from Dr. Bux' state and from Louisiana, and from my own Ozarks that had as fine a bunch of fur on them as you ever saw on any seal on the coast of Alaska. They would have had a fine fur collar with the exception they had some large bristles which perhaps was a little mixture of porcupine. Furthermore, the hogs had wattles. A lot of you northern fellows won't believe it; you will think it is one of my laughs. If you doubt it, ask any southern men and they will say they see wattle hogs in the hills of the southern country. They are not hogs, and you cannot expect them to live and thrive as hogs.

I remember one time a man shipped in a load from New Orleans. They were web-footed. (Laughter) They were fat hogs. He kept them on his place all winter long, and they never gained one-half pound apiece. That is not a joke, it is the truth. He could not do anything with them. He shipped out what he did not kill.

As to public-market hogs, the same rule applies. I am not going to mention any certain markets. I am not here to boost certain markets, and I am not here to run down certain markets, but a market that draws its pig supply from the farming communities of the Middle West, where they have well-bred, thrifty, well-fed hogs, possibly raised under the McLean County system —those hogs will ride and go to the feed-lot and make money for the man who has his name on a note in the local bank. If he goes to a market that trades in a hill-billie type of hog, he is not going to get anything but a pain out of it, gentlemen. That is all there is to it. (Laughter)

As to the losses, I will say that the heaviest losses that have ever been reported to our office are reported by men who write in after the 21-day report has been returned. In other words, they are losses that occurred thirty days and more from date of vaccination. That to me is nothing in the world but a virus break. That is all it is, and you can't make anything else out of it. The thriftiest hogs that ever came into the state of Missouri from any state, came in from South Dakota about two years ago. They were great big, nice hogs, very healthy and very thrifty. One man bought 2000 head, and he did not lose five hogs out of the 2000 head. By the way, that man did this: The hogs were vaccinated over thirty days before shipment, just as soon as they got on his place, he had the local veterinarian come out and revaccinate every hog. He paid no attention to the past vaccination at all. Another man in Aberdeen bought hogs that were vaccinated over thirty days, shipped them in here and thought he had immune hogs; went out in about eleven days and found the hogs with their heads down on the ground and tails hanging down.

DR. J. E. GIBSON: I think in 1926 more hogs were shipped into Indiana for feeder purposes than during any year, within my recollection. It happens to be my business to follow up the shipments on which we get reports. You all know we get reports on hogs shipped from public stockyards. I made it my business to follow the shipments, and I think I can count on the fingers of my one hand all the cases in which we were called on account of heavy losses of hogs shipped from public yards. On the other hand, I doubt if I would have fingers and toes enought to enumerate the number of cases where the losses in country shipments were distressingly heavy. That has been our experience in Indiana.

DR. J. I. GIBSON: I don't know whether the essayist gave the temperature in the cases of dysentery. If so, I did not get it. I was anxious to know what temperature the hogs present which are infected with the dysentery.

PRESIDENT VAN ES: Dr. Whiting will reply to your question at the end of the discussion.

DR. A. J. DEFOSSETT: Our conditions in Ohio on shipment of feeder hogs are almost identical with what Dr. Gibson from Indiana reported. We also have followed these shipments, and conditions are so identical that it is not necessary to repeat them.

DR. WILSON: Where do your country shipments come from?

DR. DEFOSSETT: From the southern states.

DR. WILSON: That explains it. (Laughter)

DR. M. W. RAY: Last year our state of South Dakota was an exporter of feeder pigs. This year we are an importer of feeder pigs. The versatile gentleman from Missouri has given you to understand that shipments originating in South Dakota, being shipped to Missouri, have not had proper immunization. We do not doubt the fact that some shipments probably go forward which are not properly immunized, the same as they do in other states, but we do believe the immunization of hogs is probably up to the standard with other states.

We have had this year a number of shipments coming from the St. Paul yards, and we have found so far that our reports show the losses from hogs shipped from the St. Paul yards have been much greater than hogs shipped direct from the country districts. Of course, in that instance, they are immunized according to the federal regulation, whereas hogs shipped direct from the country districts are brought in on a permit and immunized at destination. We do not find that we have had any breaks from the public stockyards. Losses are due to other causes, probably mostly pneumonia. We have not had that trouble where they have come from the country districts.

DR. WILSON: Mr. President, I don't want the gentleman from South Dakota to think I was casting insinuations on the type of vaccination they perform. It simply interlocks with the theory that this dumb-bell has had for a number of years: Hogs immunized in one section of the country, with serum made in that section of the country, and shipped 500 to 1000 miles, are not always capable of withstanding the type of infection they come in contact with under the new environment. I believe that hogs vaccinated in

Missouri, raised in Missouri, vaccinated with Missouri-made serum, from a Missouri strain of virus, and shipped to Dakota or any other state in the Union, would be just as apt to break, as the Dakota hogs would, when they are shipped to Missouri. The only one safe way, after all is said and done, of handling a stock hog, is to do exactly like they did with us when we joined the army. When they got out the syringe we sidled off and said, "Doc, I had that about two weeks ago."

"I don't care, you will get it again."

That is the whole thing in a nutshell. (Laughter and applause)

DR. HAYS: I would like to stress a point Dr. Embree brought out. We handle a great many stock hogs. We divided them into two phases. The early shipments coming direct from farm to farm, we have very little trouble with. As the season advances, and difficulties are experienced in securing hogs, the assembling and holding of hogs at the point of origin probably contributes a great deal of trouble. We have small stockyards to deal with in that case, and the hogs become stale, the same as they do in public stockyards. We have heavy losses in the later shipments at certain periods.

DR. EMBREE: There is another point in connection with your collections of hogs at country points that has been of considerable interest to me. I was out investigating losses from a certain point in the West last winter. Many hogs had been vaccinated around the railroad yards by a local veterinarian. There had been no attempt to destroy the virus bottles. They were lying everywhere. The railroad man in charge of the yard did not realize the importance of destroying the virus bottles, and I doubt if you could imagine a yard more contaminated with virulent virus than that particular yard. It is something that local men should look after in connection with the handling of hogs, in order to keep down the infection around yards where stock pigs are being collected.

DR. WILSON: I would like to ask Dr. Embree if the public stockyards are any better.

DR. BIRCH: In that connection I could conceive of how the hogs shipped from public stockyards would be no more dangerous than those shipped from the country distance, although I do not believe that would be true. But I can not conceive of how they can be improved by going through the public stockyards. They all come from the same source anyhow, they come from the farm. How can they be improved by going through a public stockyard?

DR. EMBREE: It does not improve some of them.

DR. WHITING: Mr. Chairman, answering Dr. Gibson's question, the average temperature of several hundred dysentery hogs was 104.8° F., with extremes of 106.2° F.

I would like to ask Dr. Gibson, of Indianapolis, with reference to the outbreaks they were called in on. Were those outbreaks you could count on one hand hog cholera or dysentery?

DR. GIBSON: It was hog cholera.

DR. WHITING: I would like to say to Dr. Ray, of South Dakota, these outbreaks have not been a question of hog cholera immunity. Many hogs showing dysentery are immune to hog cholera.

. . . A motion for the adoption of the report was regularly made and seconded. . . .

DR. HAYS: I want to reiterate the question of apparent discouragement to the use of serum and virus, in a recommendation to the swine-owner that he shall use serum and virus only where it is necessary. That is what I can interpret from that, and I believe the swine-owner would interpret it the same way.

Nebraska went to a considerable expense in advocating the use of serum and virus in a systematic program of swine production. If I were making a recommendation to a man, who was going to produce swine that were going into the channels of traffic and become feeder hogs, it would be to treat his herd and those swine with serum and virus, and have them protected, regardless of the future treatment. If a man were buying the hogs in my state, I would recommend he treat them again. I do not believe it would be an extravagant expenditure. I can wholly recommend that atti-

tude, and I would object to this report and would like to enter a motion, if necessary, to have reconsideration on that point.

DR. BIRCH: May I read the part of the report which refers to vaccination? I am sure this is a misunderstanding on the part of the gentlemen as regards the meaning, not only as regards the meaning intended by the Committee, but what it says.

"Your Committee believes that for a long time to come vaccination must play an important part in the handling of hog cholera, but that vaccination alone, effective as it is in the individual herds treated, is not the solution of the hog cholera problem."

"Nor is the mere extension of vaccination the only, or the most important consideration. Your Committee believes that some herds require vaccination, others do not."

Is there any objection to that? "That herds needlessly or improperly vaccinated are a menace to others in the vicinity."

DR. HAYS: What would "needlessly" mean?

DR. BIRCH: It would mean about 70 per cent of the hogs in some states. We don't all have Nebraska conditions. It is "needlessly" because we know the herds do go through without infection.

"That herds definitely threatened require prompt and effective vaccination." That, I think, is conceded. In the circumstances you described, there is nothing in the report which would indicate that a feeder or stocker or any hog, which is being moved, or is a part of the herd which is receiving recruits from any source, should not be vaccinated. We are in favor of that. The point the Committee makes is that there must be a judicious selection, and not the slogan, "Vaccinate or lose." We have shown that if everybody vaccinated in this country, the losses from hog cholera would be just the same, or at least as much as they are at the present time.

"That judicious selection and careful immunization and segregation of herds definitely threatened are all-important measures."

In regard to the practicing veterinarian: "The careful education of his clients regarding the manner in which hog cholera spreads. The judicious selection of the herds in his vicinity which require immunization."

If it is necessary in Nebraska to make that selection and say that all of them require vaccination, if you have the machinery to do it, that is the thing to do, but that is not the case in all states. That is the selection, not just the wholesale vaccination, and assuming that is going to solve the problem.

"Careful examination of all herds before vaccination, and the avoidance or postponement of serum-virus vaccination in the presence of devitalizing influences.

"Great care in the technic of vaccination, and in the preservation of serum and virus; ample doses of both products and avoidance of the use of outdated material.

"Due attention to the care of the herd subsequent to vaccination."

Those are the recommendations regarding vaccination.

DR. HAYS: Just one more word, and I will quit. In Nebraska, as in every other state, I believe the practice of insuring property against fire is a very good practice and is recognized, yet in Nebraska our loss is not very great from fire, yet we carry the insurance. Keeping the same theory of good business principles, in Nebraska the hazard of hog cholera is greater than fire, and it is nothing more than insurance to vaccinate swine in Nebraska. I think that is true of Iowa and of the central states that are producing the swine population of our country. Going out as a recommendation of this Association, any discouragement to the vaccination will be a hardship upon us.

DR. BIRCH: Mr. Chairman, I still say that is not meant as discouragement to vaccination. There is nothing in it which says that. It emphasizes the fact that we must make these selections, and that we must use good vaccination where we do any. That is what this says.

DR. WILSON: I would like to interrogate Dr. Birch just one moment. Did I understand you to say if all the hogs in the United States were vaccinated, the losses would be as great as they are from hog cholera now?

DR. BIRCH: Mr. Chairman, the statement is that if we lose 2 per cent following vaccination, or incidental to vaccination, and if we vaccinated every hog in the United States, which is the logical termination of the program of just vaccinate or lose, the cost of serum and virus and the veterinary fees to do that would at least equal the hog cholera loss in the last decade.

DR. WILSON: I don't doubt that, but under the 2 per cent loss, this thing would be spread out in a blanket form over all hog-raisers. As it is under present conditions, it is just the poor yokel on a farm that loses them all. It is the few fellows who are standing the enormous loss.

DR. BIRCH: If we are going to follow just the principle of insurance, we can get an insurance company to do that. What we are trying to do is to limit the spread of hog cholera in the United States, if we can do it.

DR. WILSON: You will have to build a wall 100 feet high around every hog.

PRESIDENT VAN ES: Before I put the question on the adoption of this report, I wonder if the question does not simply hang on this: that the Committee perhaps has not fully recognized that there is some section of the United States where it would be well to have every hog vaccinated, and in other sections we could get along without such a measure. I suppose that your action on the report of the Committee largely hangs on that question, if I may so interpret the discussion.

Are there any further remarks?

DR. C. H. STANGE: We have a few hogs in Iowa, and we are losing between $10,000,000 and $15,000,000 worth of hogs from disease, other than hog cholera. If we attempted to practice general vaccination, I think we would double our losses from hog cholera, because we have a great many herds that are not in condition to be vaccinated. We have too many herds today that are vaccinated, which should not be vaccinated, as a result of which vaccination our losses are very heavy. It was the hope of some of us, when serum was first brought out, that this agent would be used as a control measure. It has developed into purely an insurance proposition.

I do not think that there is any biological product that has been so misused and so abused as hog cholera serum, and, as somebody has said, it is used by everybody, in some sections at least, who desire to use it. I do not know of any other product which we use for the control of animal diseases that is used in such a careless and slipshod manner as hog cholera serum. Of course, there is no use talking about vaccinating all the hogs. Such a thing is a physical impossibility. But the Committee desires to call attention to the fact that greater care should be used in the selection of herds to be vaccinated, that this careless use of hog cholera serum should be controlled to a greater extent than it is. In other words, the use of serum should be made more effective in the control of the disease. That is the desire of the Committee.

Heretofore, we have talked about vaccination altogether. This year we would like to emphasize that other things are necessary in addition to vaccination. So that is the reason the Committee brought in this kind of a report. It is not to discourage vaccination. We all appreciate the value of it. But I think we have gone vaccination crazy in some sections, and we think that if we vaccinate a herd, that is all there is to it. A lot of our farmers have the idea that if they vaccinate the hogs, we have guaranteed the hogs will go to market. That is a very serious mistake.

With no other biological product do we insure the man's hogs or his cattle or any other live stock. Still, the farmers have gotten that idea into their heads—if they vaccinate the hogs, they can go to bed and sleep peaceably and the hogs are going to live.

We are losing a lot of hogs from other diseases, and we lose a lot of them right after vaccination, too, simply because the hogs are not in condition to be vaccinated. The Committee believes that more attention should be paid to the herds that are vaccinated, and see that they are in condition to be vaccinated. There is necessity for vaccination for the control of hog cholera. That is the object of the whole thing—to control hog cholera. I am sorry that the discussion got away from the control standpoint.

DR. A. T. KINSLEY: It seems to be unfortunate that the Committee did not put this in so many words. As I understand the report, it carries some-

thing more there, or at least it will when this report becomes public property and I think that we as an Association would better recommend vaccination as a control measure, as has been stated, and particularly urge vaccination during the early life of the pig, after weaning, when it costs little, and, by the way, Dr. Stange, before some of these other diseases gain a foothold.

I want to know what you are going to do in a community in which these various other diseases are raging, and cholera infection becomes prevalent. You will certainly lose the large majority of hogs whether you vaccinate or leave them unvaccinated. Therefore, why not recommend early vaccination, when the vaccination will cost less, and where your hog will be protected against at least one of the complicating factors that cause such extensive losses in swine?

One other thing, Mr. Chairman, that I am rather pleased with, is to note that this Association now thoroughly recognizes other diseases of hogs than hog cholera. Not so long ago, I can remember, one would be laughed at here, if he mentioned that some other thing actually happened to swine than hog cholera. It seems now these are coming into their own and being recognized as very important factors in preventing losses among hogs. In repeating, I would say, why not recommend vaccination as a control measure and urge the early vaccination, when the cost is less to the farmer.

DR. BIRCH: I would like Dr. Kinsley to give us some idea as to what he considers early vaccination.

DR. KINSLEY: After the pigs have been weaned and are accustomed to their other mode of living.

DR. I. K. ATHERTON: Do you mean universal vaccination?

DR. KINSLEY: I believe in some sections that is advisable.

DR. BIRCH: We have to leave the selection of the method to somebody paid for making the selection. That is what is contained in the report.

DR. U. G. HOUCK: I have listened to this discussion on hog cholera and the use of serum-virus with a great deal of interest. Naturally, being connected with the Hog Cholera Division of the Bureau, we receive reports of various kinds from different sections of the country, and different interests of the country. The Bureau, of course, was instrumental in developing anti-hog cholera serum and the preventive treatment. Conditions, though, have changed considerably since this treatment was first developed. I was talking with Dr. Dorset but a few days ago with regard to the early experiences, and it was very rarely that they had an outbreak of hog cholera following the simultaneous treatment. They felt that at that time they could sell the clients, after vaccination, this kind of insurance, they could go to bed and feel sure the hogs would go to market the next fall.

Conditions have changed considerably since the treatment was first developed. We have had the development of other diseases, the spread of parasitic infestations, and we have learned more of parasites on the farm than we did at that time, that is, as general practitioners. We have become more careful in regard to the matter of applying this treatment. I am in accord with those who recommend the early treatment of pigs, that is, soon after weaning time. Even with that precaution we also have to exercise the same care in the selection of the herds to be treated.

There are various conditions in young pigs which would preclude a possibility of favorable results through the application of virus, because they are not in condition to receive it. We have to be just as careful in the selection of our herds of young pigs as we have for older hogs.

The question has arisen as to what we would do in a community where we had so many different diseases, and we were to find hog flu and extensive parasitic infestation or necrotic enteritis, or other conditions which impair the vitality of the animal. What would we do if we had hog cholera in that community? My answer would be: I would not give the simultaneous treatment to hogs in that condition. I would give the serum-alone treatment, and carry them with the serum-alone treatment until I got them in condition to receive the other treatment, if it were possible to do so. That would be the only reasonable way of handling that situation. We are having more and more of those situations from year to year, as those hogs from

Missouri spread the parasites through our northern states. We are having more and more of this condition. (Laughter)

On the whole, I think we are not very far apart in agreement on the Committee's report. I regard it as a very good, sane report. The Bureau does recommend vaccination, extensive immunization in the densely hog-populated sections where we have hog cholera constantly.

Following the outbreak of 1926, we did recommend more extensive vaccination in Missouri and in the more densely hog-populated sections, but we would not, as a general rule, recommend that simultaneous immunization should be extended to all of the hogs in all of the states, because there are some states that have very little hog cholera. There are large sections of some states that have no hog cholera and have not had any for years. Some never had it. We would not recommend the extensive immunization to those sections. In the hog-raising sections, for instance, Nebraska, we did recommend more immunization than ever before, and we regarded it as good insurance in densely hog-populated sections where hog cholera exists almost continuously.

DR. WILSON: Mr. President, I will have to defend Missouri about the parasites. Dr. Houck, they may be full of them.

If you will recall a number of years ago, one of Dr. Houck's coworkers worked out a system on the parasites here in Illinois, thus showing that Missouri is not the only state that has them. On the other hand, that coworker advocates the application of cosmetics to the mammary glands of the sow. Just take it from me, don't you go down in the Ozarks and try that. (Laughter) You might just as well go down to Florida and try to massage the abdomen of a she-alligator as to pull a stunt like that. (Laughter)

PRESIDENT VAN ES: Gentlemen, a lot of light has been thrown on this question. I wonder if you are prepared to act on the report? There is already a motion for acceptance. Are you ready for the question?

DR. BIRCH: May I just say one word? Lest I be misunderstood, I want to say I am perfectly willing and very glad, provided the other members of the Committee are agreed, to include in the report the recommendation that hogs that require vaccination shall be immunized as young pigs, provided the interpretation of "young" pigs be made to mean "after they are through weaning and over the effects of the weaning, and accustomed to the change in feed and surroundings." I am opposed to anything in the report which would give the impression that we just advised that as a blanket measure to cover this country, advising men to immunize even their young pigs, or else lose them.

I think that inclusion would strengthen it, but I do not want the other impressions carried to the point that that is the beginning and end of hog cholera.

DR. F. H. BROWN: Dr. Kinsley made a wise explanation. If you say vaccinate hogs early, carry with it a definition of what you mean by early. In some sections of our state the Bureau's inference that the pigs should be vaccinated early has carried with it, unmeaningly on their part, that the pigs should be vaccinated when they are two, three or four weeks old. In those cases, where we are meeting some pigs that have immunity, the results cast reflections upon the whole treatment.

PRESIDENT VAN ES: Are you ready for the question? All those in favor of the acceptance of the report will signify by saying "Aye"; all those opposed by "No." The ayes have it and the report is adopted.

We will proceed with the program. The next number is a paper entitled, "Studies on the Agglutination and Pullorin Tests for Bacillary White Diarrhea as to the Efficiency of Each in Detecting Carriers of *Salmonella Pullorum* Infection," by Drs. H. J. Stafseth and Frank Thorp, Jr.

. . . Dr. Stafseth read the paper. . . .

STUDIES OF THE AGGLUTINATION AND PULLORIN TESTS FOR BACILLARY WHITE DIARRHEA AS TO THE EFFICIENCY OF EACH IN DETECTING CARRIERS OF SALMONELLA PULLORUM INFECTION

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Introduction

Successful control of bacillary white diarrhea depends largely on the removal of infected birds from breeding stock. As far as we know, most carriers of *Salmonella pullorum* can be detected only by the aid of certain diagnostic tests. Until recently the slow agglutination test has been used for this purpose. As discrepancies in results have been rather common, it is natural that various modifications in the methods of applying this test should be fostered, in the hope of being able to devise a more efficient test, some modifications of the rapid agglutination test, and the pullorin or intradermal test. For the two last tests some biological manufacturing concerns or laboratories are offering test fluids for sale, and in the case of one laboratory, at least, to poultrymen. Extraordinary claims of accuracy and simplicity for certain ones of these tests are made by their proponents. Consequently, numerous inquiries have come to our laboratory relative to the merits of the various tests. These inquiries, together with our own desire to know more about these tests and to improve them if possible, prompted the work which we are about to present.

Methods of Procedure

For our experiment fifty birds were selected. Two of these had given strong reactions to the slow agglutination test, two had been immunized with dead cultures of *S. pullorum*, one had been injected with a live culture of *S. pullorum*, one had been fed live cultures of *S. pullorum* five times, one had been injected with a filtrate from a culture of *S. pullorum* and one had been immunized with *S. jeffersonii*. The other birds had given partial or doubtful reactions to the slow agglutination test. All these birds were placed in one pen and comparative agglutination and pullorin tests were made at intervals of two weeks. The samples of serum for the agglutination test were

taken immediately before injecting the pullorin and were drawn by the syringe method as described by Martin and Olney.[1] The vials were placed in a slanting position, so that a small portion of the bottom of the vial would not be covered with blood, left at room temperature for about one hour, or until the serum had started to separate from the clot, and then placed in a refrigerator until the tests were made.

Three kinds of antigen were used for the slow agglutination test, namely: Antigen I containing 0.5 per cent phenol as preservative and 2 cc of a 2 per cent solution of NaOH per 100 cc of antigen. This was according to the recommendations of Mathews[2] and Mallman,[3] antigen II containing 0.5 per cent phenol, and antigen III containing 0.1 per cent formalin according to the recommendations of Beach and Ter-Michaelian.[4] All these antigens were prepared by growing *S. pullorum* for 48 hours at about 37° C. on liver-infusion agar in Kolle flasks, then washing off the growth with sterile 0.85 per cent NaCl solution, after which the antigen was filtered through a sterile cotton-gauze filter. If the salt solution did not contain the desired preservative, it was added immediately after filtration. The sodium hydroxid solution was not added to the stock solution but was added to the amounts needed for each day, just before using the antigen. All equipment used in preparing antigens was sterile.

Antigens for the rapid agglutination test were prepared in a similar manner except that the cultures were allowed to grow for 72 hours and 12 per cent salt solution was used for washing off the growth and diluting the antigen. Phenol (0.5 per cent) was used as preservative. The turbidity of the antigens for the slow test was always comparable with tube I of McFarland's nephelometer. For the rapid test a 1-50 dilution of the antigen was comparable with tube I of McFarland's nephelometer. Two of these antigens were washed once with phenolized physiological salt solution and concentrated until a titration with known positive sera gave what seemed to be a satisfactory reaction, i. e., the reactions were more distinct and fewer doubtful reactions were observed. In the slow agglutination test four tubes were used containing 1 cc of antigen each, and 0.04, 0.025, 0.01 and 0.005 cc of serum. The serum-antigen mixtures were incubated at 37° C. for 24 hours, when readings were made. A second reading was taken after an additional incubation period of 24 hours.

The rapid agglutination test was performed as follows: 0.02 cc of serum was placed on a glass plate. To the serum one drop of antigen was added from a pipette standardized to size 15 of the wire gauze. Toothpicks were used for mixing the serum with the antigen, after which the plate was tilted back and forth for a few moments in order to bring out the reaction more plainly. The glass plate was not heated, as the test may be performed with better results if it is standardized so that it will work at room temperature. It took less than three minutes for the reaction to take place even with what we have termed late reactors and after no appreciable change took place, except a drying-out of the serum-antigen mixture. In the rapid test two commercial antigens were used according to the directions given by the laboratories concerned.

Pullorins were obtained from two biological manufacturing concerns, and were also used according to directions. The reactions were read and recorded independently by three persons about twenty hours after the injection of the pullorin.

When the desired number of tests had been made the birds were killed, examined for lesions of bacillary white diarrhea, and cultures made from the liver, spleen, gall-bladder, heart, ovary, oviduct, egg concrements, cysts or abscesses, on plain liver-infusion agar and agar containing a 1:100,000 dilution of brilliant green. All but two ovaries were completely inactive and difficulty was experienced in making satisfactory cultures from them. At first they were merely cut to pieces with scissors and placed in brilliant-green-broth tubes. Later an attempt was made to crush them in the tube by means of a glass rod and finally both these procedures were given up in favor of grinding them in a mortar, the ground mass being mixed with physiological salt solution and then added to tubes of brilliant-green broth, incubated for 24 hours and then plated out on brilliant-green and plain agar. The cultures obtained were transferred to dextrose, sucrose, lactose, maltose and mannite broths containing about one per cent Andrade's indicator, and incubated for 24 hours, at the end of which time the results were recorded. When necessary, the tubes were incubated 48 hours.

Results

The results of this work are recorded in table I.* In the case of the slow agglutination test, two readings will be found for each test. The upper one was made after incubation for 24 hours and the lower one after incubation for 48 hours.

*On account of the extremely large dimensions of table I, it was found impractical to publish it here. Editor.

DISCUSSION

Of the three antigens used for the slow agglutination test, the one containing sodium hydroxid was found to be the most sensitive. Next in order of sensitiveness came the plain phenolized antigen and last the one preserved with formalin. A marked increase in the number of reactors was noticed after the first injection of pullorin in the case of all three antigens. Following the second injection of pullorin (different pullorins were used), only the formalinized antigen showed an increase in number of reactions. The antigen containing sodium hydroxid gave the most constant number of reactors, the difference between the lowest and highest number of reactors being 12. For plain phenolized antigen the difference was 17 and for formalinized antigen 23.

No proagglutinations or zone phenomena were observed with the antigen containing sodium hydroxid, while 33 were encountered with plain phenolized antigen and 17 with formalinized antigen. Bird 570 failed to react in the 1:25 and 1:40 dilutions with formalinized antigen after incubation for 24 hours. After 48 hours a weak reaction appeared in the 1:40 dilution in the first test and a trace in the second test. This bird reacted well in all serum dilutions with the two other antigens every time it was tested. Bird 887, which reacted strongly in all serum dilutions with the antigen containing sodium hydroxid, gave marked proagglutination in the second test with plain phenolized antigen and failed to react to formalinized antigen throughout. All antigens used in the rapid test showed strong reactions with the serums from both these birds in all tests run. It will also be noted that both birds were found to harbor *S. pullorum* in the ovaries. The relative merit of the three antigens used for the slow test is, therefore, quite evident as far as these two birds are concerned. A composite sample of serum that had howed positive reactions to the sodium hydroxid antigen in a 1:640 dilution and partial reaction in a 1-1240 dilution reacted poorly with phenolized antigen and failed to react with formalinized antigen. This sample also gave strong instantaneous reactions with all antigens used for the rapid test and was used as a control sample throughout the experiment.

As regards clearness, the reactions given with the antigen containing NaOH were superior to those obtained with the other antigens. Formalinized antigen usually gave very indistinct re-

actions and in many instances the reaction disappeared after the tubes had been shaken.

In most cases more reactions were found after incubating 48 hours than after 24 hours. As a rule the birds that failed to show reactions in 24 hours gave only very weak reactions after an additional 24-hour incubation period.

From the data obtained it seems that the antigen containing NaOH is most satisfactory, not necessarily because it is the most sensitive, but because it gives the most definite reactions, eliminates cloudy reactions almost entirely, and does not show proagglutinations, at least when diluted to a turbidity equal to that of tube 1 of McFarland's nephelometer. We have failed to find a single proagglutination with this antigen in more than 25,000 routine tests when 1:40 and 1:100 dilutions were used, while this phenomenon was quite frequently observed when plain phenolized antigen was employed with the same serum dilutions. If a one-tube test is to be adopted, it is evident that no antigens can be employed that will give proagglutinations. This phenomenon can be overcome by increasing the turbidity of the antigen, but this also has a disadvantage as it renders the reading of the test more difficult. It seems, therefore, that an antigen treated with NaOH offers marked possibilities for the one-tube test. If it should prove to be too sensitive, one can use less serum and by so doing cloudy reactions will also occur less frequently.

What dilutions should be used and how long one should incubate the serum-antigen mixture still remains undetermined. We feel that, when using an antigen containing NaOH, it may not be necessary to use dilutions lower than 1:50 and perhaps not even so low as that. It also seems that an incubation period of 24 hours is long enough.

Some workers have suggested that bacterial contamination of serum may lead to false reactions. This may be possible, especially when the birds are bled by the old method. We carried out some tests using sera taken by the old puncture method and also by the method devised by Martin and Olney, for the purpose of seeing if there might be any marked difference in the results, but we failed to notice any. However, it was found that sera taken with a syringe would keep longer and were much more satisfactory to handle, so we are much in favor of this method of taking blood samples for the agglutination test. In looking for errors due to bacterial contamination we found it to

occur in one batch of antigen. For this reason we now employ strict precautions against contamination in making our antigen. We also use sterile salt solution and sterile glass-ware, as far as possible, in all the steps of the test, for the purpose of guarding against the introduction of mass contamination.

The difference between the number of birds that were found to be infected and the number of reactors found is very great, but it must be remembered that some of these birds had been immunized and most of them were bought because they had given positive, partial, or doubtful reactions previously. These birds came from a flock that showed 5.14 per cent reactors to the routine test. The infected birds as well as the ones that had been immunized gave marked reactions to one or more of the different agglutination tests with the exception of bird 947. This bird received one injection of a living culture and it is possible that the infection did not establish itself in such a way that a lasting immunity-reaction was produced. The increase in the number of reactors that took place during the experiment might be due to the injection of pullorin or to constant exposure to infection in the pen.

THE RAPID AGGLUTINATION TEST

Two commercial antigens and four made in our own laboratory were used for the rapid test. The antigen designated as M2 is the same as antigen M1 except that the former was washed once with phenolated physiological salt solution and concentrated. Antigen M3 was washed and concentrated in a like manner, after which it was designated as M4. These antigens were prepared in our laboratory. The washing process decreased the sensitiveness of the antigen, as indicated by the disappearance of several weaker reactions. No difference was noted with the strongly positive sera.

The commercial antigen designated as antigen J was decidedly less sensitive than any of the other antigens. It was also very dilute and therefore gave less distinct reactions than the others.

While the results of the rapid test obtained with the different antigens show some discrepancies, it will be noticed that the results obtained with some of them agree quite closely with the results obtained with sodium hydroxid antigen in the slow test. If contamination plays a part in the production of erroneous reactions in the slow test, it must of necessity be depen-

dent on the time factor and since no lengthy incubation period is necessary in the rapid test, this source of error can at least be eliminated. Furthermore, the rapid method offers a greater opportunity for the study of types of reactions which may have great possibilities, in view of Dr. Huddleson's findings, which show that it may be possible to differentiate between infected and immune animals by means of the rapid agglutination test. Dr. Huddleson's work will be presented later at this meeting. Since learning of his discovery we have been watching the types of our agglutinations both in the slow and rapid test. So far we have not been able to differentiate between infected and immune birds. This failure may be due to the antigen used or we may not have had any immune birds. We have obtained reactions that resemble Dr. Huddleson's infection reaction and a difference in the type of agglutination obtained with the serum from different birds has been noticed. What this may mean or what possibilities it might present is difficult to say.

Our work did not substantiate the claims of the manufacturers of one of the commercial rapid-test antigens, that its use would eliminate doubtful reactions and hence would make the test so clear and simple that anyone could employ it regardless of previous experience or training.

Most antigens have a tendency to decrease in turbidity as time goes by. Some show this change sooner than others. This is not caused by a mere settling-out of the bacteria but is evidently due to some lytic process. The agglutinability may also decrease more or less rapidly. In some instances old antigens may become unstable in the sense that the addition of any kind of serum, positive or negative, will bring about partial or doubtful reactions. This was the case with the antigen referred to above that showed bacterial contamination.

The Pullorin Test

A year ago a number of veterinarians in Michigan requested that we should include work in our Short Course program that would enable them to perfect themselves in the application of the pullorin test and also in the intradermal tuberculin test for avian tuberculosis. In order to comply with their request, we selected a number of birds with known records as regards behavior toward the agglutination test for bacillary white diarrhea and the intradermal test for tuberculosis. The results of the work with the pullorin test are shown in table II. It will be

noticed from an examination of this table that the results were extremely erratic. One might argue that the men performing the tests were inexperienced and that the lack of experience would account for the poor results obtained. However, as the tuberculin test was performed with a very high degree of accuracy, one is forced to conclude that the fault lay with the pullorin test and not with the men who performed it.

During the month of July, 1927, we made a comparative study on the slow agglutination and pullorin tests in collaboration with a practicing veterinarian who tested two flocks with the pullorin test and, at the same time, drew blood samples for the agglutination test. He brought the blood samples to our laboratory and did all of the work in connection with the agglutination test except the reading of the results which was done by us on the following day. The record of the results of the pullorin test were not consulted until after the agglutination test had been read and the reactions recorded. There were 96 birds in flock 1, of which 23 were positive and 16 partial or doubtful, so that one might say that 40.6 per cent reacted to the test. To the pullorin test, 19 were positive and 6 partial or doubtful, making the percentage of reactors to this test 26. Thus, there were 14.6 per cent less reactors to the pullorin test than to the agglutination test.

In flock 2 there were eighty birds, of which thirteen gave positive reactions and eleven partial or doubtful ones to the agglutination test. In all there were 30 per cent reactors. With the pullorin test, ten reacted positively and three partially, making in all 16.2 per cent reactors, or 14.8 per cent less than found by the agglutination test.

The fact that fewer birds reacted to the pullorin test than to the agglutination test was not the most disturbing feature of our findings, because it is possible that the antigen used in the agglutination test might have been oversensitive or faulty in some other way. The embarrassing thing was that a considerable number of the birds that reacted to the pullorin test did not react to the agglutination test and vice versa. However, confusing as these results may seem, neither test need necessarily be condemned by them, as similar discrepancies exist between other biological tests commonly used in the diagnosis of disease.

A study of table I will show that the pullorin employed Oct. 20, 1927, gave a very large number of doubtful reactions. The three

men, who read the results of the test, found it very difficult to decide as to what should constitute a reaction. For this reason considerable disagreement will be found in the results recorded by them. Only three birds (419, 487 and 4) were picked by all three readers as positive or distinct reactors. Neither of the two birds that were found to be infected by bacteriological examination (570 and 887) showed sufficient reaction to be called even strongly partial by any of the men who examined these birds. This pullorin also failed to produce any reaction in the immunized or artificially infected birds used in our experiment.

The pullorin used Nov. 31, 1927, gave a few more reactors. The three men who read the results of the test agreed that four birds (436, 487, 98 and 838) were either marked partial or positive reactors. Bird 98 had been immunized with *S. jeffersonii*. It will be noticed that with this pullorin also, both of the infected birds failed to give a distinct positive reaction. Birds 468, 570 and 1240 were considered as partial reactors by two of the men who read the results; one of these birds (1240) was recorded as positive by one of the men and it will be noticed that this bird had been immunized with dead cultures of *S. pullorum*.

The consensus of opinion of those who helped with this experiment is that the reactions produced by the pullorins used were too indefinite to be relied upon in most cases. When we also consider that the infected birds failed to react, as did most of the immunized birds, it seems that the weight of the argument is against this test. Edwards and Hull,[5] of the Kentucky Experiment Station, came to the same conclusion.

In our bacteriological work we employed brilliant-green agar as indicated above. This was done because Mr. Mallman,[6] a member of our staff, has shown that *S. pullorum* will grow well in a solution of this dye that will prevent growth of *Escherichia coli*. Our results showed that, whereas a number of our plain agar plates had growths of *E. coli* or other organisms on them, most of the brilliant-green agar plates were sterile. Control plates of brilliant-green agar, inoculated with *S. pullorum* culture, showed good growth.

Conclusions

1. Antigen containing NaOH is superior to the other antigens used because it gives the clearest reaction, shows no tendency to produce proagglutinations and will almost entirely eliminate cloudy reactions.

TABLE II—*Results of pullorin tests of birds previously tested by the agglutination method. (Work done in collaboration with the State Department of Agriculture)*

BIRD*	REACTION	FIRST READING†	SECOND READING†	TOTAL	AGGLUTINATION TEST	LAST INTRADERMAL TEST‡	AUTOPSY¶
(1) 1150	— + ++	38 8 0	34 9 1	72 17 1	Negative	—	—
(2) 1013	— + ++	27 16 2	36 5 2	63 21 4	Negative	—	—
(3) 101	— + ++	11 32 4	15 25 1	26 57 5	Negative	—	?
(4) 558	— + ++ +++	9 32 3 0	15 22 4 1	24 54 7 1	Negative	—	—
(5) 129	— + ++ +++	8 28 8 1	19 22 3 0	27 50 11 1	Negative	—	—
(6) 233	— + ++ +++	1 0 8 37	0 0 5 39	1 0 13 76	Positive	±	+
(7) 2104	— + ++ +++	17 16 10 3	12 25 5 0	29 41 15 3	Positive	+	+
(8) 282	— + ++	11 22 13	16 25 3	27 47 16	Positive	+	+

(9) 758	—	35	34	69	Positive	±	+
	+	11	9	20			
(10) 442	—	6	6	12	Positive	++	+
	+	14	25	39			
	++	20	10	30			
	+++	6	2	8			
(11) 1021	—	44	40	84	Doubtful	—	+
	+	1	2	3			
	++	0	0	0			
	+++	1	0	1			
(12) 125	—	4	5	9	Positive	+	+
	+	7	23	30			
	++	24	16	40			
	+++	11	0	11			
(13) 348	—	38	36	74	Doubtful	±	+
	+	6	5	11			
	++	1	1	2			
(14) 1004	—	16	16	32	Positive	±	+
	+	26	23	49			
	++	4	3	7			
	+++	0	1	1			
(15) 127	—	42	35	77	Doubtful	±	+
	+	2	8	10			
	++	1	0	1			
	+++	1	0	1			
(16) 399	—	20	24	44	Positive	+	+
	+	20	16	36			
	++	5	4	9			
	+++	1	0	1			

+ = positive; ± = partial or doubtful; — = negative.

*Number in parenthesis is number at first reading. Leg bands were changed between first and second readings. Lower number in each case is the leg-band number at second reading.

†Number of men recording birds as —, +, ++ or +++.

§Performed by one person.

¶Definite lesions of bacillary white diarrhea, found on autopsy, indicated by +.

2. Formalinized antigen produced very indefinite reactions, showed marked zone phenomena or proagglutinations and seemed decidedly lacking in sensitiveness, as some of our strongest sera failed to react with this antigen.

3. The results obtained with the rapid test indicate that it may become the most practical and useful test employed for the control of bacillary white diarrhea. We do not feel that it is so simple that it can be used indiscriminately by anyone who chooses to do so, regardless of previous training or experience.

4. In order to obtain the best possible results with any modification of the agglutination test, a satisfactory way of standardizing or, perhaps better, titrating antigens must be found.

5. Fresh antigens are usually more satisfactory than those that have been kept for more than two weeks.

6. An incubation period of not more than 24 hours seems sufficiently long when sodium hydroxid-treated antigen is used.

7. From all our experiences with the pullorin test, it seems that this test is decidedly inferior to the agglutination test as regards its ability to pick out carriers of *Salmonella pullorum*.

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PRESIDENT VAN ES: We will proceed with the next paper, "Comparison of Mortality in Chicks Suffering from Bacillary White Diarrhea and Normal Chicks," by Drs. H. M. Scott, W. R. Hinshaw and L. F. Payne, of the Kansas Agricultural Experiment Station.

. . . Dr. Hinshaw read the paper. . . .

COMPARISON OF MORTALITY IN CHICKS SUFFERING FROM BACILLARY WHITE DIARRHEA AND NORMAL CHICKS*

By H. M. SCOTT, W. R. HINSHAW *and* L. F. PAYNE

Manhattan, Kansas

The percentage and distribution of mortality in chicks infected with bacillary white diarrhea has been mentioned by many writers. The majority have expressed the opinion that the

*Contribution No. 41 from Department of Poultry Husbandry, and Contribution No. 98 from Department of Bacteriology, Kansas Agricultural Experiment Station.

period of greatest mortality occurs between the fourth and tenth days and that the losses decrease very rapidly after that period, until negligible after the fourteenth day. Losses have

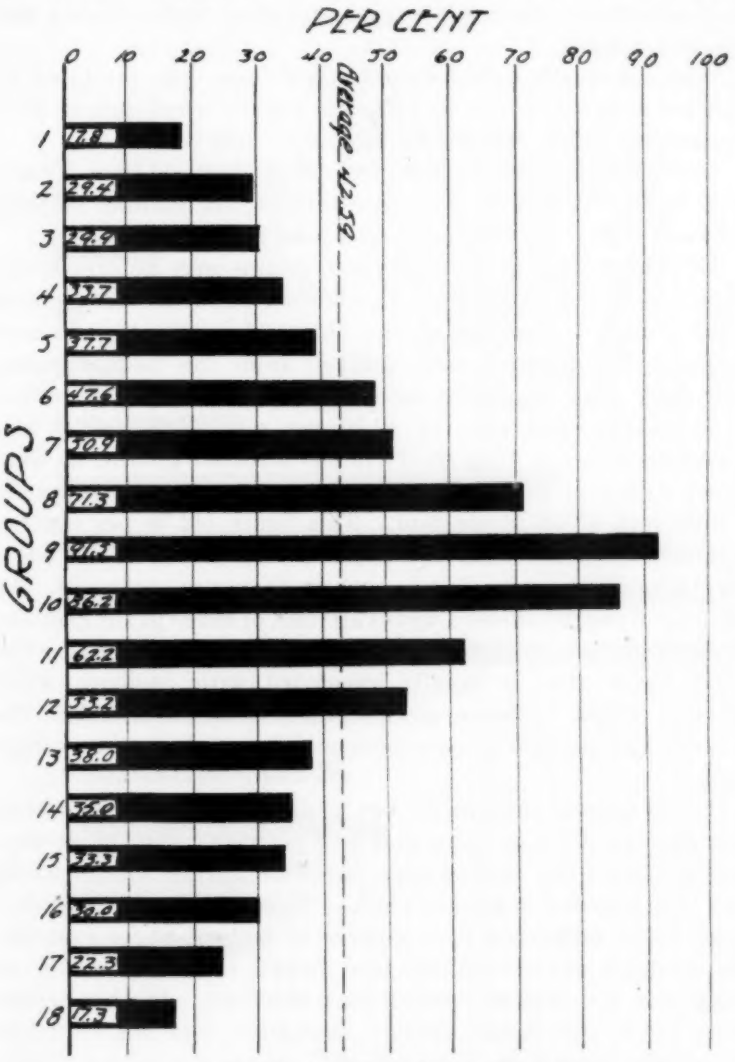

CHART 1. Variations in bacillary white diarrhea mortality.

been reported from 25 to 100 per cent, but few average figures are available.

The writers have contrasted mortality data involving 1162 chicks suffering from bacillary white diarrhea with 919 normal

chicks reared for fourteen days in indoor brooders. The diseased chicks were hatched at various times from January 4 to July 16 and divided into eighteen groups. The normal chicks were also hatched during the same period and they were divided into fourteen groups.

Diseased chicks were hatched either from eggs produced by females reacting to the *S. pullorum* agglutination test or from disease-free stock exposed to incubator infection.

Normal chicks were hatched from eggs produced by a disease-free flock. This flock was tested twice, six months elapsing between tests. No reactors were found in the two tests.

All chicks dying in the thirty-two groups were autopsied and examined bacteriologically. *S. pullorum* cultures were isolated from a high percentage of the chicks dying in the diseased groups. No cultures were isolated from the normal chicks that died. Daily mortality records were recorded for all groups.

An average mortality of 42.59 per cent (495 chicks) was experienced in the 1162 chicks in the diseased groups, as compared with 6.31 per cent (58 chicks) in the normal groups, or a difference of 36.28 per cent. This figure (42.59 per cent) is considerably lower than the popular conception of the losses due to bacillary white diarrhea where there are outbreaks. An analysis of chart I shows a wide variation of losses in the eighteen diseased groups; from 17.3 per cent to 91.5 per cent. It is the latter figure that is usually associated with bacillary white diarrhea losses. Eleven groups experienced losses below the average figure, while seven experienced losses above the average figure.

It is of interest that, in the two groups in which the mortality was greatest (91.5 per cent and 86.2 per cent), the chicks were not hatched from reactor eggs but were normal chicks which had been exposed to reactor chicks. This variation in mortality is no doubt influenced by a number of factors, as for example, the virulence of the organism, the dosage, the immunity of the chick and the sanitary precautions observed. In this experiment the fourth factor, namely, sanitation, was not varied in any of the groups.

Chart 2 shows the percentage of total chicks dying in infected and normal groups by daily periods. Mortality commenced earlier, reached a higher peak on any one day and continued for a greater period in the diseased groups than in the normal non-infected groups. For the first five days of the brooding

period the average mortality for the normal groups was .64 of one per cent, while during the same period the average mortality of the diseased chicks was 4.28 per cent (six times as great).

The period of greatest mortality in chicks suffering from bacillary white diarrhea occurred from the sixth to the twelfth day, reaching its peak (6.88 per cent and 6.79 per cent) on the

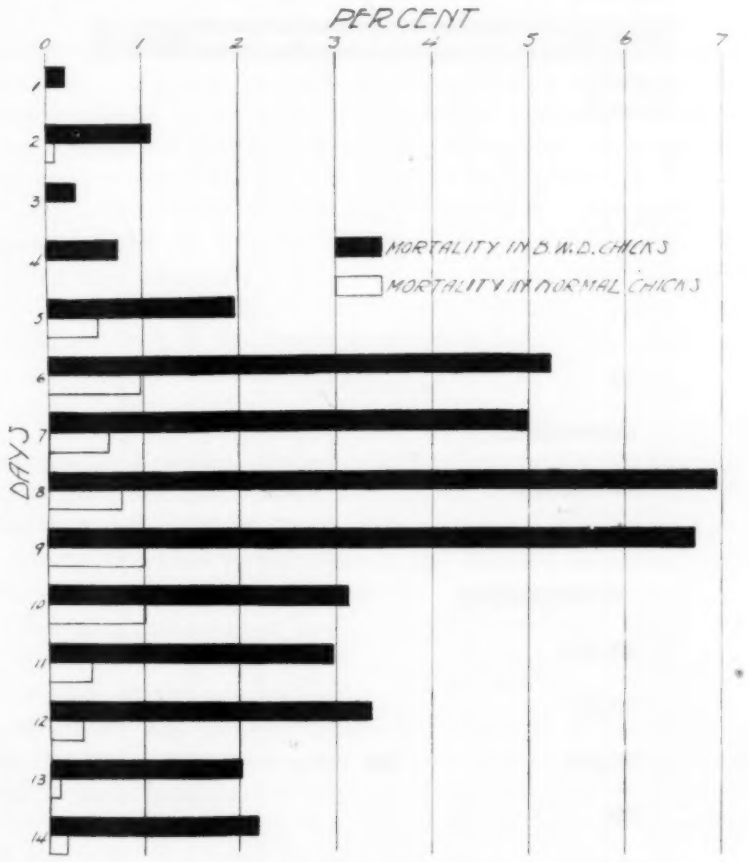

CHART 2. Period of mortality.

eighth and ninth days. The period of high mortality in the normal chicks occurred between the sixth and tenth days and reached the peak of 1.08 per cent on the ninth and tenth days. This would indicate that the period of high mortality in diseased and normal chicks is reached about the same time, with a tendency to arrive a day earlier in the former group.

Mortality in the diseased groups continued through the fourteenth day, while in the normal groups it was negligible at this time. It is unfortunate that the brooding period was not lengthened three days. The chicks were removed from the experimental brooder on the fifteenth day, but were grown out

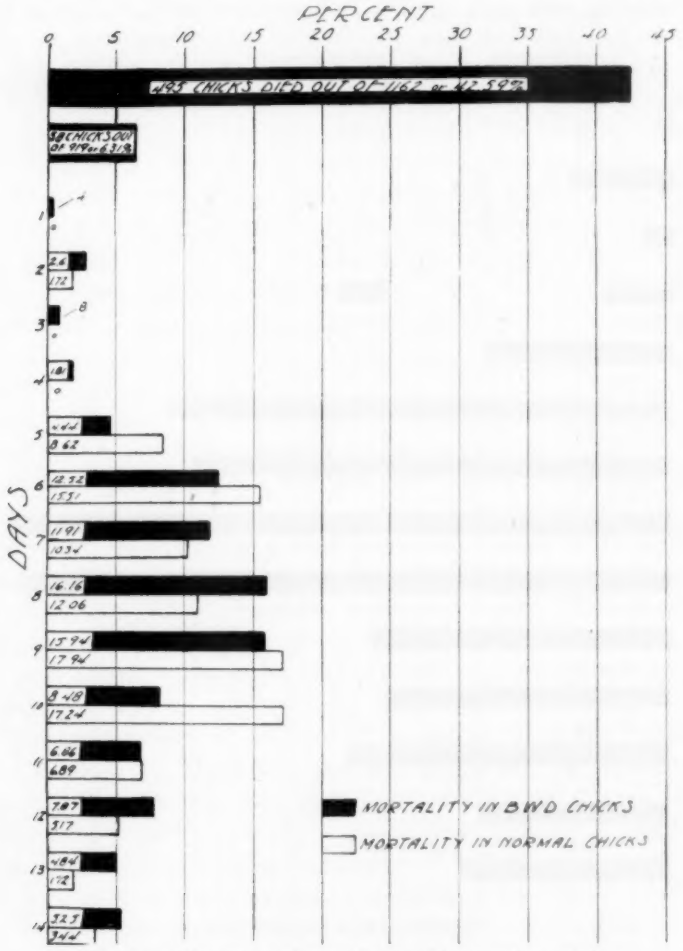

CHART 3. Distribution of mortality over a fourteen-day period.

and sold as broilers. It may be said, however, that a very small percentage of mortality occurred after the fourteenth day. Many of the chicks surviving, however, were inferior individuals.

One of the most interesting features of chart 2 is the sudden variation in mortality exhibited by the diseased groups as com-

pared with the more uniform and gradual variations found in the normal groups.

Chart 3 presents the distribution of mortality for the fourteen-day period in a different manner than in chart 2. The sum total of the dark columns equals 100 per cent, or 42.59 per cent mortality experienced in the diseased chicks. The sum total of the light columns also equals 100 per cent, or 6.31 per cent mortality of normal chicks. The number of chicks brooded does not enter into the calculations as in chart 2, but was calculated from the 495 chicks dying in the diseased groups and 58 chicks dying in the normal groups. Over 62 per cent of the total mortality in the diseased groups occurred from the sixth to the tenth day. During the same period 72 per cent of the mortality in normal groups occurred. The mortality peak of 16.16 per cent for the diseased group occurred on the eighth day, whereas the peak was not reached until the ninth and tenth days in the normal groups. On both of these days 17.24 per cent of the losses occurred.

Conclusions

The average mortality in a 14-day brooding period for 18 groups (1162 chicks) infected with bacillary white diarrhea was 42.59 per cent. The average mortality for 14 groups (919 normal chicks) was 6.31 per cent.

Mortality varied considerably in the diseased groups, ranging from 17.3 per cent to 91.5 per cent.

Mortality commenced earlier, reached a higher peak, and continued for a greater length of time in diseased chicks than in normal chicks.

Mortality was greatest in diseased chicks from the sixth to the twelfth day, and the peak (6.88 per cent) occurred on the eighth day. In normal chicks the period occurred between the sixth and tenth days and the peak (1.08 per cent) was reached on the ninth and tenth days.

President Van Es: The next in order is the report of the Committee on Poultry Diseases. Dr. Hinshaw.

. . . Dr. Hinshaw read the report. . . .

REPORT OF COMMITTEE ON POULTRY DISEASES

DR. W. R. HINSHAW, *Chairman*, Amherst, Mass.

Dr. R. A. Craig, Lafayette, Ind.
Mr. S. S. Knight, Petaluma, Calif.
Dr. Robert Graham, Urbana, Ill.
Dr. E. L. Stubbs, Philadelphia, Pa.

At the twenty-ninth annual meeting, the Committee on Poultry Diseases recommended that the Association voice its sentiment concerning poultry sanitation. This was done in the form of a resolution. Sanitation was further emphasized at the thirtieth annual meeting and your Committee wishes again to stress this need.

Two years ago, at the suggestion of President Mohler, the Committee concentrated its efforts on two diseases, namely, avian tuberculosis and bacillary white diarrhea. Studies on these diseases were made and reported at the thirtieth annual meeting. In connection with bacillary white diarrhea, tentative recommendations regarding standard methods for making the agglutination test were made. These recommendations were accepted by the Association and were printed in the Proceedings of the thirtieth annual meeting.

This year, at the suggestion of President Van Es, your Committee has concentrated its efforts toward a study of the tentative recommendations made a year ago. To this end, the Committee has been attempting to follow the suggestions given in the conclusions of the Committee's report of last year.

Such a program calls for more than one year's work and your Committee felt it advisable to concentrate on only one phase of the problem this past year. The Committee has had definite proof that several states have been trying the proposed recommendations and recommends that during the next year an attempt be made to gather further information regarding the efficiency of the tentative plan for standardization.

The problem in this connection with which your Committee has been concerned this past year, was studying the causes for variations in interpretations of results by different laboratories in the testing of samples of sera from the same birds. It is a commonly accepted fact that biological tests in the hands of different technicians, no matter how well they are trained, will show some discrepancies due to individual differences in interpretation of the same results. The sole object of the work described below was to find methods of improving, rather than to condemn, the agglutination test.

The following Agricultural Experiment Station laboratories cooperated in this work:

State	*Cooperator*
Illinois	Dr. Robert Graham
Michigan	Dr. H. J. Stafseth
Nebraska	Dr. L. Van Es
Virginia	Dr. R. A. Runnels
Kansas	Dr. W. R. Hinshaw

The Committee at this time wishes to express its appreciation to the men who cooperated in this project.

Due to the fact that the work completed to date can be considered only preliminary, the results are withheld for further checking. These results, with details of the work accomplished, will be passed to the new Committee. Your Committee recommends that the problem be continued and makes the following suggestion. That sectional meetings of men interested in bacillary white diarrhea continue to be held for the purpose of furthering standardization of technic, manufacture of antigens, and interpretation of results. At these meetings comparative agglutination tests should be made. Autopsy of the birds and a thorough study of the results obtained by each man should follow such procedure.

Your Committee believes that the control of bacillary white diarrhea and other poultry diseases should be voluntary with the poultry-owner, but that some agency of accreditation under the supervision of an official agency should protect the owner in maintaining a disease-free flock.

The states which are obtaining the best results are the ones that have regulatory measures regarding the care of the flock after it has been tested by trained technicians.

There is also a need of uniformity of such regulations and your Committee urges that the Association voice its sentiment in this matter. Standardization of terms regarding accreditation of flocks, uniform methods of disposal of reactors, and cleaning and disinfection of premises are all problems for future consideration and study.

Your Committee, at the suggestion of your President, has prepared recommendations regarding the accreditation of flocks for freedom from disease and has given these recommendations to your Committee on Unification of Laws and Regulations, to be reported jointly with the Committee.

A survey made by one member of your Committee (S. S. Knight) showed no new disease developments in the western part of the United States. The results of this survey of the poultry disease situation in seven western states and British Columbia would indicate that worm infestations, colds, roup and the associated diseases, coccidiosis and bacillary white diarrhea were the principal diseases met in these states and one province. This survey further indicated the necessity for sanitation and proper breeding methods as primary aids in controlling disease among poultry.

All cars and coops in which live poultry is transported should be thoroughly cleaned and disinfected before being used again.

The survey mentioned above also emphasized the need for the use of more mature stock for breeding purposes, as a disease control measure. There seems to be a growing tendency in some sections of the country to use birds during their first laying season for breeding purposes. This practice is to be discouraged, because of the lowered vitality and greater susceptibility of progeny of such birds to disease.

In conclusion, your Committee wishes again to urge further study of the tentative recommendations for making the agglutination test, which were given at the thirtieth annual meeting of the Association. It can do no better than to repeat the conclusions of the Committee on Poultry Diseases for last year. They were as follows:

> "Your Committee recommends that the U. S. Live Stock Sanitary Association address itself to a representative group of workers engaged in bacillary white diarrhea control and to request that a limited number of flocks be tested in accordance with the standards here tentatively proposed, and that the results be placed at the disposal of the organization, accompanied by such comments as may be relevant to the subject so that a definite opinion may be formed as to the potential value of the proposed testing technic."

As a result of the surveys made this past year, your Committee believes that efforts should be concentrated on the improvement of test fluids, getting more accurate field results of the efficiency of the present methods of control of bacillary white diarrhea, and continued effort toward standardization of terms, regulatory measures and technic.

PRESIDENT VAN ES: You have heard the report. What is your pleasure?

DR. HINSHAW: I move that the report be accepted.

. . . The motion was seconded, put to a vote and carried. . . .

PRESIDENT VAN ES: There yet remains some time for the discussion of the papers presented in connection with the program of poultry diseases. Does anyone wish to avail himself of that opportunity?

MEMBER: I read that a cubic centimeter of pullorin was injected under the skin in the wattle, and the reaction consisted of a swelling, the same as the intradermal. There may not be anything to it, but I wonder if anybody else read it, and if there is anything to it.

PRESIDENT VAN ES: One cubic centimeter of anything injected in the wattle will always make a swelling, whether it is pullorin, water or quicksilver.

Dr. Stafseth is better prepared to answer that.

DR. STAFSETH: I never heard anything of it.

PRESIDENT VAN ES: If there are no further remarks, this ends the program for this afternoon and a motion to adjourn will be in order.

. . . It was moved, seconded and carried that the meeting adjourn. The meeting adjourned at 4:10 p. m. . . .

THURSDAY MORNING, December 1, 1927

The third session convened at nine-thirty o'clock, President Van Es presiding.

PRESIDENT VAN ES: The first paper on the program is by Dr. J. P. Iverson, on "State Meat Inspection." Dr. Iverson. (Applause)

STATE MEAT INSPECTION

By J. P. IVERSON, *Chief, Division of Animal Industry*

California Department of Agriculture
Sacramento, Calif.

This country can boast of a federal system of meat inspection probably surpassing that of any other nation. By no means, however, have we succeeded in affording by this work the maximum protection to all consumers. This will not have been accomplished until a better method of inspection can be devised which will provide an effective service to those parts of the country not enjoying the protection given to consumers served by abattoirs engaged in the interstate shipment of meats.

Many attempts have been made by states, counties and municipalities to establish a system of inspection similar to that of the Bureau of Animal Industry, but, in many instances, these efforts proved futile because of local difficulties which rendered the project subject to modifications until only a desultory inspection resulted. In seeking the reasons for these unsatisfactory results, one is prompted to feel that the underlying principle pertaining thereto was not accorded the necessary consideration, particularly under our democratic form of government. The prime factor in the development of any public service is legislation, which must be obtained with the support of the masses, or there will be but little hope of carrying on the project to a successful conclusion. Constructive legislation can be accomplished best by proper education of the majority concerned and this applies to meat inspection as well as other public enterprises.

Since we can point with pride to our federal system of inspection, the question arises how shall the next united effort be directed in order to extend the scope of this service permanently. As the state is the largest unit of authority, it appears logical

that commonwealths should consider this problem, and if desired results are accomplished, then counties and municipalities should experience less difficulty in following suit, thus supplementing federal inspection and extending the same measure of protection to all.

It is granted that it is much easier to preach the ideal than to achieve it. However, it would hardly seem fair to criticize anyone endeavoring to suggest feasible plans for the improvement of prevailing conditions.

It is hoped the foregoing will not be construed as advocating the neglect of county or municipal meat inspection until the state is prepared to inaugurate the service. Any expedient is better than none, and every community is justified in instituting measures to protect the health of its population when the state is unprepared to lend the desired assistance.

Notwithstanding late advances made in public health and disease control, as early as 1910, the late Dr. A. D. Melvin, then Chief of the Bureau of Animal Industry, estimated that a little more than half of the total meat supply of this country was prepared under federal inspection. In his bulletin, he stated that little or no inspection was given to the remaining half of our national meat supply, except a limited portion receiving city or state inspection.

He stressed the need for local inspection to supplement the federal system, which is powerless to exercise supervision over establishments where meat is prepared and consumed within a state. Notwithstanding his excellent suggestions showing the need for this work, most of the states, apparently, have but weakly attempted to organize any system of state meat inspection.

The California legislature, in 1915, recognizing the need for some agency, other than municipal, to conduct meat inspection in plants not doing an interstate business, passed a law empowering the office of State Veterinarian to grant inspection to such establishments. This work proceeded in a very limited way until 1921, when the more comprehensive California Meat Inspection Law was passed.

Briefly, this law provides authority for the Department of Agriculture to maintain supervision over all slaughtering establishments in California, except those operating under federal or existing municipal inspection. Authority was given the Department to maintain continuous postmortem supervision in estab-

lishments, provided the owner paid the required inspection fee, maintained a proper sanitary standard, and observed the regulations. Provision was made also for the unrestricted sale of meats bearing the state stamp of inspection in any part of California.

In connection with the inspection fee, it should be stated that at the time this law was considered, in 1921, governmental costs had greatly increased during the few preceding years. It was felt by the proponents of this act that it would be impossible to obtain a sufficient appropriation for the support of an extensive postmortem meat inspection work. Especially was this believed to be the case because of the fact that the State, previous to that time, had not been conducting this service on anything but a very limited scale. I am sure that all who have had experience with legislatures and appropriations can realize how futile it would be to endeavor to get a worth-while appropriation out of a clear sky, so to speak, for a new piece of work.

The procedure necessary to obtain an inspected meat supply for a city or county is rather simple, merely requiring the passage of an ordinance forbidding the sale of uninspected meat within the corporate limits. The passage of such an ordinance thereby makes it mandatory for slaughterers in the area to make application to the State Department of Agriculture for postmortem inspection.

Since the law became effective, many municipalities and several counties, recognizing its value, have passed ordinances affording protection to these communities against the sale of unwholesome meat. The favorable reception accorded this adventure is evidence that its operation is meeting with public approval. Numerous requests for service have been received from cities not maintaining inspection and from several cities that had instituted municipal inspection but elected to turn the work over to the State. To date, state inspection has been inaugurated in fifty-nine cities and four counties. This system has the advantage of removing the enforcement of meat inspection from local influences. The employment of inspectors rests solely with the Department of Agriculture. Municipal inspection is not always satisfactory, since, in some places, the work simply consists of an examination of meat exposed for sale. Such a system is of little value. It may result in the removal of some unwholesome products, but its effect is not sufficiently far-reaching to be of much benefit. However, it is only fair to

say that large cities providing adequate funds and appropriate assistance for their health departments can operate a creditable system of meat inspection.

As provided in the federal plan of procedure, state inspection may be withdrawn from establishments violating the meat inspection law. Another valuable feature is the authority vested in the Department to require establishments not operating under postmortem inspection to meet a higher standard of sanitation. In this work alone, over five million dollars have been expended by slaughterers in building new abattoirs and remodeling old plants, with the result that most noticeable improvements have been made in such establishments in California. The authority given the Department over all slaughtering establishments has been recognized as being of great value in improving badly needed sanitary conditions in country abattoirs. I am not advised or informed concerning conditions in the various states in this respect, but I do know that in the past, or previous to the time I refer to here, many hundred country slaughtering establishments were operating in California without regard or respect for sanitary conditions, or appointments. The expenditure in six years of approximately $5,000,000 in remodeling and rebuilding these plants has resulted in a very, very noticeable improvement in these conditions. Refrigeration has been installed in over fifty plants not formerly equipped with cooling facilities. It is gratifying to state that the progress in this respect is appreciated alike by producer and consumer.

While the California plan of meat inspection has functioned satisfactorily during the past six years, and the progress made has justified the undertaking, the writer is not prepared to assert that other states can proceed along similar lines with benefit. Doubtless, in some commonwealths, the entire meat supply is obtained from abattoirs doing an interstate business. However, for states not so served, consideration might be given to the provisions of the California law which may offer some suggestions for a suitable statute.

The growth of state work is indicated by the following figures:

Year	*Establishments*
July 1, 1921	1
July 1, 1924	86
Nov. 1, 1927	93

At the present time, seventy veterinarians are employed in state meat inspection. Two or more of the smaller plants in

some localities are under the supervision of one inspector, necessitating a designated time of slaughter so that each establishment may be afforded the required inspection.

In the rural districts, this work has aided materially in bridging the gap that formerly existed between the federal-inspected abattoir and those operating under municipal inspection in California. While it is not regarded as closely approaching perfection, nevertheless, this activity has been responsible for a reduction in the sales of unwholesome meat, and for the maintenance of a higher standard for the producer and legitimate dealer.

PRESIDENT VAN ES: The next paper on the program is one entitled, "A Campaign for Safe Milk," by Dr. Herman N. Bundesen. Is Dr. Bundesen here? He does not seem to be here.

The next in order is the report of the Committee on Meat and Milk Hygiene. Dr. George Hilton.

DR. HILTON: Mr. President and Gentlemen: The report which I have the honor to present to you is the unanimous opinion of the members of the Committee, who considered it advisable to render the report in a brief, concise manner and to the point.

. . . Dr. Hilton read the report. . . .

REPORT OF COMMITTEE ON MEAT AND MILK HYGIENE

DR. GEORGE HILTON, *Chairman*, Ottawa, Ont.

Dr. L. A. Klein, Philadelphia, Pa. Dr. H. Busman, Chicago, Ill.
Dr. Hadleigh Marsh, Helena, Mont. Dr. W. G. Hollingworth, Utica, N. Y.

The excellent report of last year's committee covered the question of meat and milk hygiene so fully, from the economic point of view, as well as from the public health standpoint, that we have found our field for new ideas much restricted.

We desire to stress the very great importance of conserving the health of a nation, by adequate protection of the food supply of its people, and that, as live stock sanitarians, we must demand that our meat and milk supply comes only from healthy animals, that it is prepared, stored and handled under sanitary conditions, and reaches the consumer, in a clean and wholesome state.

In the case of meat, the first and most important step to prevent diseased meat getting into circulation is the establishment of public or union abattoirs, where slaughtering can be conducted under inspection methods similar to those carried on for export and interstate trade, by the federal authorities on this continent.

We are of the opinion, that while some smaller governing bodies are apparently maintaining a creditable domestic meat inspection service under difficult circumstances, the sooner the inadequately equipped, insanitary, small slaughterhouse is entirely abolished, the better for all concerned, as most of the objectionable meats placed on the market emanate from these undesirable and insanitary places. With every small butcher operating his own slaughtering establishment, it is hardly possible for the local authorities to provide for inspection at the time of slaughter.

The thoroughness of the Federal Meat Inspection Service has undoubtedly created a sentiment in favor of the establishment of similar expert inspection for domestic trade, but local authorities have not, generally speaking, responded.

A systematic propaganda campaign, in cooperation with public health officials, would appear to be very desirable, as the sooner the consumer limits his purchases to meats which bear the marks of reliable inspection, the sooner will the local authorities realize that they must provide a suitable domestic meat inspection service.

We believe that the education of the public, in a quiet and unassuming manner, is the very best type of propaganda, and that, while it is slower than legislation, it is more effective.

As milk is the only animal food used in the raw state, and the best and cheapest of the most universally used foods entering our homes, the great importance of a pure milk supply to the health of a nation cannot be overestimated. The question of public health is of much concern. It is inseparable, from our duties, as live stock sanitarians, and we cannot, therefore, evade the moral obligations which we owe to humanity.

We are of the opinion that milk obtained from cows reacting to tuberculin should not under any circumstances be permitted to be sold for human consumption.

We desire, however, to point out particularly that, from a public health standpoint, tuberculosis eradication is only one element, and that it is important that this very laudable endeavor is not permitted to overshadow the protection of our milk supply against other bovine infections, and contamination from human sources.

A tuberculosis-free herd is not necessarily a healthy one, and sound and wholesome milk can be furnished only by sound cattle, free from disease and properly managed.

We should, therefore, go further, and prohibit the use of milk from cows affected with any disease which may, or which is likely to, infect the milk with any organism pathogenic for man, or which may cause any change in the consumption, taste or odor. We cannot hope for a reasonably safe milk supply unless every cow in every herd producing milk is healthy, is maintained under sanitary conditions, that the milk is promptly cooled to a temperature of at least 54° F., is maintained at a low temperature, and is handled in a clean sanitary manner, by clean, healthy people.

We also appreciate the fact that even under these conditions milk may in various ways be rendered dangerous from human sources, and especially so as a medium for the dissemination of such diseases as typhoid fever, scarlet fever, septic sore throat and diphtheria.

Live stock sanitary officials should confer and consult with public health officials, to ensure that proper supervision is exercised over the people handling milk, as experience teaches us that disease may be disseminated through milk contaminated by those handling this product.

While pasteurization is undoubtedly of value as a protective measure, much of the so-called pasteurized milk is not actually pasteurized, owing to carelessness or defects in the process of pasteurization. We desire expecially to point out that even correct pasteurization should not be permitted to replace clean production and healthy cows.

A clean product from healthy cows, kept under sanitary conditions, should be the basis of our milk supply, after which pasteurization may, under certain conditions, be desirable to protect the consumer from later contamination of this supply.

We are, however, of the opinion that where pasteurization is deemed advisable, this procedure should be permitted only in establishments under proper official supervision and control.

In view of the fact that improper pasteurization may leave the milk exceedingly dangerous, and give a false sense of security to the consumer, we are of the opinion that all milk and cream entering our cities, towns and villages should pass through distributing plants under official supervision.

We realize that, after adequately protecting the source of supply of these products, the responsibility of guarding the supply until it reaches the consumer rests very largely with the public health officials, but we believe it is our duty to impress our convictions upon them, and assist in every possible way to provide a wholesome, safe milk supply.

DR. HILTON: I move the adoption of the report.

. . . The motion was seconded. . . .

PRESIDENT VAN ES: Are there any remarks?

DR. IVERSON: I hesitate to speak to the body because I heard such an extensive discussion yesterday concerning the passage of a resolution and where, it seemed to me listening from the sidelines, that almost everyone entering the discussion was of the same frame of mind. However, it is not quite clear to me whether the Committee recommends that milk be not used for food purposes if produced by reacting cows. If that was the Committee's recommendation, I am wondering if it isn't rather a long step for the Association to take at this time, since I am of the opinion that in a great many, probably in most of our states, products produced by such animals are now being marketed.

If that is the intent of the Committee, I shall have to confess that they have stepped way ahead of us in the West. It may not be generally known, but in 1915 California passed a law prohibiting the sale for public consumption of any milk or dairy products not produced by animals tuberculin-tested by the State Department of Agriculture, and, for the enforcement of that law, provided funds for a rather sizeable force of veterinarians, to be paid by the State. That was twelve years ago. At that time, I think very few sections, and certainly no other states, were requiring similar health provisions.

I would like to ask the Chairman, Dr. Hilton, to explain, if he will, just that one thought in the Committee's recommendation, and to leave the question in your minds, whether or not we should go on record as condemning the use of these products in their entirety at this time.

DR. HILTON: The members of the Committee, as you know, are very widely separated, and we have not had the opportunity of discussing the matter together. The report was prepared by correspondence. I cannot definitely speak for each member of the Committee, except that whatever I read in the report was unanimously agreed to by all members of the Committee. I think the Committee is of the opinion that as a recommendation to this body of sanitarians, they could not do otherwise than to recommend that milk from reacting cattle should not, under any circumstances, be sold for consumption. That is our attitude, Mr. President.

PRESIDENT VAN ES: Are there any further remarks? Are you ready for the question?

. . . The question was called for, put to a vote and carried. . . .

PRESIDENT VAN ES: Does any one want to discuss the paper of Dr. Iverson.

DR. W. G. HOLLINGWORTH: I am very sorry to know that New York State has not the pride of having a meat inspection law similar to that of California. New York State is taking, in my opinion, a retrograde step, for the simple reason it is just the lack of education, and public sentiment has not been aroused to the extent of realizing the necessity of a state-wide meat inspection law. I took it upon myself, inasmuch as I owed a duty to the city in which I live, if I was in any way capacitated, to render a better quality of meat inspection, which was naturally a public health measure, and we finally succeeded in getting municipal meat inspection.

It took a great number of years to bring it about, because I did not seem to go at it in the right way. I went to the politicians and people of that kind, which I thought was the proper way to go at it, but I found, after about ten or fifteen years' experience, it was of no account. At last I made up my mind that the only thing to do was to go to the public. We started discussions through our service clubs, and I remember on one occasion, in about three-quarters of an hour, we did as much as had been done in fifteen years. We created a meat inspection ordinance. Of course, the officials were very much peeved to think I went over their heads, but the public sentiment was so aroused, it was made a necessity, and it was a demand. Today with the meat inspection ordinance we have in the city of Utica, which followed along the ideals of the Bureau of Animal Industry, we have succeeded in establishing one as near as possible like that of the mother organization. We have just about completed a large abattoir, which is displacing all the small butcher markets, and we have eliminated that fear of "Beware of the high cost and low price."

What I mean by that is, years and years ago, anything and everything could come right into the City, and it was disgusting. It was just a matter of the nearest butcher. The inferior butchers were bringing it about. We have now about 65 per cent of the meat that is consumed, federal-inspected, and the other 35 per cent is municipal-inspected.

This last year we handled through out department over 15,000,000 pounds of meat, that was beef, pork, mutton and veal, with the condemning of some, of course, that went to the incinerator. Inasmuch as it is a public health matter, you must have the cooperation of the Health Department and of the health-respecting public. By keeping the conditions before the public, and emphasizing the fact, and letting them know what is going on, and things of that kind, the result is you are going to have efficient work. On things like that, all the money that is expended by the Health Department, or by the city, naturally comes from taxation. When you can go to work and bring that about, and instruct the public that they are paying taxes to enhance public health, to me it is an easy matter. What happened in one city can happen in another. It is the veterinarians who are to blame, as far as that goes, in their localities, for the reason they do not take the initiative. They do not start the campaign, whatever it may be. Some say, "Well, I have talked to a great many, and I am blowing my own bugle. I am looking for a job myself."

"Certainly you are. Who has a better right?"

If the veterinarians could go to work and enhance this condition in their community, it would be fine. It is a duty they owe. If they do not live up to the ideals, they are not fit for their calling. That is my idea about it. It seems to me it is up to us to go to work and enhance that ideal along that line. (Applause)

PRESIDENT VAN ES: Is there any further discussion? If not, we will proceed with the program. The next part of the program will be devoted to tuberculosis. The first paper is "The Progress New York Has Made in the Eradication of Bovine Tuberculosis," by Dr. E. T. Faulder, of Albany, New York.

DR. FAULDER: It is indeed a pleasure to be able to come here and bring to you a message on this most important subject—the progress New York and other states have made in the eradication of bovine tuberculosis. In my paper I will, by the use of two maps, facts and figures, point out progress that New York has made. I also will show in my paper quite in detail the methods that we have employed to bring about these results.

. . . Dr. Faulder read his paper. . . .

THE PROGRESS NEW YORK HAS MADE IN THE ERADICATION OF BOVINE TUBERCULOSIS

By E. T. FAULDER, *Albany, N. Y.*

Director, Bureau of Animal Industry, Department of Agriculture and Markets

The eradication of bovine tuberculosis from the cattle in New York is a health measure of vital interest to all consumers of dairy products. It is also an economic measure affecting the condition and value of all the cattle of the State and their production, as well as the reputation of the State's live stock industry among the leading states of the Union. This project is a national one for it is now in operation, and has been for a number of years, in all the states. New York has a larger problem than any other state, due to the large percentage of

infection, yet in comparison with the other states, it is making conspicuous progress; and the demand for the work from both dairymen and consumers continues strong, with insistent importunities for its continuation, expansion and completion. The elimination of bovine tuberculosis not only protects a cattle industry valued at approximately $200,000,000, but is saving the lives of countless infants.

The successful control and eradication of bovine tuberculosis requires the full support and cooperation of all cattle-owners; and this support cannot be procured and maintained unless the work of the various interested control organizations is performed efficiently, conscientiously, economically and thoroughly.

The progress that has been made in New York in the control and eradication of bovine tuberculosis is due to the following factors:

1. A plan.
2. A sound and workable organization.
3. A program.

The Plan

The outstanding features of the plan may be classified as follows:

1. All testing confined to areas—the township selected as the unit—90 per cent of the herd-owners being first signed up, or 90 per cent of the cattle represented in the sign-up before work is inaugurated.

2. It is required that all tuberculin tests be conducted by the opthalmic-intradermic method, triple tests being applied when deemed necessary by the testing veterinarian. I am confident that the combination test has an advantage of at least 12 per cent over any single method. All testing veterinarians are required to make a house-to-house canvass in the township where assigned, in order to make certain that every cow is subjected to the test. Frequently, arrangements are made to test all cattle in a township in a week's time, and this is accomplished by assigning a sufficient force of veterinarians. A map is prepared showing all roads, with the owners listed as their farms appear on the roads and the number of cattle owned by each, and each veterinarian is given a list showing the owners of the herds to be tested by him. Under this arrangement all the cattle are tested within the week.

3. All reactors are double ear-tagged, legibly branded and required to be segregated promptly.

4. Reactors appraised by competent and experience appraisers. Present force, 30.

5. Reactors shipped cooperatively to live stock commission firms at public stockyards in New York or Buffalo, graded, sold for the high dollar, and slaughtered principally at establishments where United States meat inspection is maintained. The aim is to slaughter as many as possible at official establishments where proper facilities are available for inspection and disposition of condemned carcasses and parts.

6. All infected premises thoroughly cleaned according to printed instructions issued to the owner or person in charge of each herd and then disinfected with a permitted disinfectant applied by a power sprayer operated by a layman employed by the local tuberculosis committee and whose signed certificate is required before the indemnity claim is paid.

7. Infected herds retested every 60-90 days until a clean test is obtained; all large and important herds, where infection has existed, retested at six-month intervals after a clean test has been obtained until they are accredited. Whenever one or more reactors are found in a herd, even though no visible lesions are found upon postmortem examination, the herd is considered infected, the premises disinfected, and retest ordered. Herds are not accredited until three clean tests, six months apart, or two clean tests, one year apart, have been obtained.

8. All additions to herds must be animals originating from herds operating under the Accredited Herd Plan and added strictly in accordance with Accredited Herd Rules.

9. *Quarantines:* After 90 per cent of the herds or the cattle in a township or county have been tuberculin-tested, a quarantine may be laid upon such township or county by the Commissioner of Agriculture and Markets. Quarantines have been laid upon seventeen counties and 155 additional townships. These quarantines are restrictions which prohibit the movement of cattle into or through these counties or townships unless such cattle have been tuberculin-tested within sixty days, are covered by a permit, and accompanied by a test-chart and health certificate. Only cattle of the required health status are permitted to be moved.

10. *Retesting of fully accredited herds:* An important factor in this eradication program is the bringing about of annual

retesting of fully accredited herds. Our plan is to assign townships, in which nearly all herds are accredited, to one or more accredited veterinarians for retesting at owner's expense. Being done on an area basis, this work can be accomplished at a reasonable cost to the cattle-owners.

Twenty-four counties, in which all herds have been tested, have been divided into a number of zones and a resident accredited veterinarian assigned to each zone, 84 such veterinarians now having been assigned to this work. A blanket authorization is issued to each veterinarian directing the retesting of all herds in his zone due for test.

11. *Supervision of field activities:* To assure uniformity and efficiency in conducting the work, supervision is essential. The State has, therefore, been divided into seven zones, to each of which a supervising veterinarian has been assigned (three state and four federal. These supervisors visit the veterinarians in their zones at frequent intervals, observe the injecting of a group of herds and the reading of the tests and the branding and tagging of reactors, check up on the cleaning and disinfection of premises, confer with the secretary and members of the local tuberculosis committees, and plan testing programs. They also adjust any difficulties for the testing veterinarian that may occur. This plan has now been in operation about two years and its beneficial effects are very noticeable.

The Organization

Organization may be divided into six divisions:

1. The United States Bureau of Animal Industry.
2. The New York State Department of Agriculture and Markets.
3. Cooperation of forty-two local boards of supervisors, accompanied by a gross appropriation of $225,000 for the year 1927.
4. The active participation of fifty local county tuberculosis committees having a personnel of 316 representative men.
5. Cooperation of the farm bureaus—a valuable contribution, the county agent usually being the secretary of the tuberculosis committee.
6. Confidence and cooperation of the thinking cattle-owners and the consumers of milk and dairy products.

The Program

On January 1 and July 1 of each year, a printed program is prepared, giving instructions relative to retests, etc., and outlining the extent of initial area work by townships which is to be completed, and a copy of such program is sent to the testing veterinarians, and the chairmen and secretaries of the local tuberculosis committees.

At the close of each year's work, an estimate is made as to the indemnity requirements for the ensuing year. After the appropriation has been made, a group of townships are selected for test, the estimated total reactors to be revealed being sufficient to obligate the indemnity appropriation.

Prior to 1924, considerable sporadic testing was permitted; since 1924, the work has been confined strictly to the area plan. During the years 1922-1923, county-wide drives were instituted in three of our larger counties. Since that time, however, the township has been selected as the area unit, and all organized counties are permitted to inaugurate the work on this basis and are not required to wait until the county can be tested as a whole. New York State has sixty-two counties, forty-eight of which are organized to eradicate bovine tuberculosis. A county is classified as organized, when a tuberculosis committee has been formed and an appropriation obtained from the local board of supervisors for the purpose of employing a competent county veterinarian (and oftentimes an assistant county veterinarian), for payment of his traveling expenses to and from his work, and from farm to farm; and for necessary supplies, such as a power disinfecting outfit, cattle tags, office supplies, office help, etc. During the past year forty-two counties appropriated a total of $225,000. The appropriations that will be made by the county boards of supervisors this fall will bring the total appropriations by counties up to the sum of $1,000,000.

Usually, the tuberculosis committee is composed of two or more members from the local board of supervisors, a representative from the Farm Bureau, the Grange and the County Medical Society, and two or more prominent and interested breeders or dairymen. This group selects a chairman and secretary, the secretary usually being the county agricultural agent. The duties of these committees are to carry on the educational work, hold township meetings, conduct the sign-up campaigns, report violations and assist in enforcing quarantines. Bulletins and circulars on tuberculosis are furnished by the Department for

educational purposes, the circular being entitled, "Help Eradicate Tuberculosis." The demand for this circular now exceeds the ability of the Department to furnish copies.

The appraising of all reactors in New York State is done by a force of thirty Department appraisers, after which the cattle are loaded and shipped cooperatively to slaughter centers, such as Buffalo or New York, where the animals are sorted, graded, and sold straight. This plan has resulted in increasing the average net salvage from $14.50, in 1921, to $35.03, at the present time.

Fiscal Year	*Average Net Salvage*
1921	$14.50
1922	16.85
1923	17.50
1924	14.49
1925	17.73
1926	24.00
1927	29.53
(July, Aug., Sept., Oct., 1927)	35.03

July 1, 1926-June 30, 1927, 69,392 animals were salvaged, netting an average of $29.53 per animal.

GROWTH OF ORGANIZED COUNTIES

1918	0
1919	1
1920	2
1921	10
1922	10
1923	20
1924	36
1925	44
1926	45
1927	48

TUBERCULIN TESTS MADE BY ACCREDITED VETERINARIANS AND BY ACCREDITED VETERINARIANS WORKING IN THE CAPACITY OF ASSISTANT COUNTY VETERINARIANS

Fiscal Year—July 1, 1925-June 30, 1926

	Lots	*Cattle*	*Reactors*
Clause "E" Tests	4,261	76,904	1,885
Asst. County Veterinarians	5,364	51,526	6,636
Totals	9,625	128,430	8,521

Fiscal Year—July 1, 1926-June 30, 1927

	Lots	*Cattle*	*Reactors*
Clause "E" Tests	9,717	153,088	1,559
Asst. County Veterinarians	11,826	100,625	14,043
Totals	21,543	253,713	15,602

Herds and Cattle Tested

July 1, 1926-June 30, 1927

Herds	*Cattle*	*Reactors*
73,490	808,647	67,202

Veterinary Forces Engaged in New York State

Nov. 1, 1927

Federal veterinarians	14
State veterinarians	25
County veterinarians	41
Assistant county Veterinarians	51
(Part Time)	
Accredited veterinarians retesting accredited herds under zone plan	84

Means of Making a Township or County 100 Per Cent Tested

As an effective means of testing all of the cattle in a township or a county, and thus greatly increasing the progress in the control and eradication of tuberculosis, the following provisions have been made in the agriculture and market laws of New York State:

Section 76. Quarantine on Animals or Premises.

The commissioner may order any animal or animals affected with communicable disease or which have been exposed to a communicable disease or which he believes to be suffering from or exposed to a communicable disease, to be put in quarantine and may order any premises or farm where such disease exists or shall have recently existed to be put in quarantine, so that no domestic animal shall be removed from or brought to the premises quarantined; and shall prescribe such regulations affecting animals, persons or property as he may deem necessary or expedient to prevent the dissemination of the disease from the premises so quarantined. Whenever ninety per centum of the herds of cattle or whenever ninety per centum of the total number of cattle in any town or any county have been subjected to the tuberculin test for the purpose of ridding such herds of the disease known as tuberculosis, and the owner of any bovine animal or animals in such town or county refuses or neglects to have such animal or animals tuberculin tested, then the commissioner may order the premises or farm on which such animal or animals are harbored to be put in quarantine, so that no domestic animal shall be removed from or brought to the premises quarantined, and so that no products of the domestic animals on the premises so quarantined shall be removed from the said premises.

Section 78. Examination of Cattle. The commissioner may cause a physical examination and a tuberculin test to be made by competent veterinarians of dairy cows whose milk is marketed in liquid form or manufactured into butter, cheese or other food for human consumption. Such examinations and tests may be made as frequently as available funds appropriated will permit, and as conditions, in the opinion of the commissioner, necessitate. An examination and test by any qualified and approved veterinarian may be accepted by the commissioner. If, from such examination or test, any animal be deemed by the commissioner to be infected with tuberculosis or any other communicable disease or its condition be such as to render it undesirable for the production of milk or a menace to the health of other animals or persons, such animal shall be immediately removed from the herd, slaughtered or otherwise disposed of as the commissioner may prescribe.

PROGRESS UNDER TOWNSHIP AREA PLAN

	Years	*Townships Tested*
May, 1918 to June 30, 1924	6	112½
July 1, 1924 to June 30, 1925	1	137½
July 1, 1925 to June 30, 1926	1	135
July 1, 1926 to June 30, 1927	1	121
July 1, 1927 to Nov. 19, 1927	5 mos.	31
Total		537
Number of townships in the State		940

On March 21, 1927, an amendment was made to the law, whereby New York State may now pay indemnity on cattle which have not been in New York State for six months prior to slaughter, provided we have proof that the animal came from a herd under state and federal supervision. This law reads as follows:

Section 88, subdivision 6. No indemnity shall be paid unless the animal, * * * * if a bovine shall at the time ordered destroyed have been within the state for at least six months, except that in the discretion of the commissioner, indemnity may be paid for a bovine which has not been within the state six months, provided that the animal at the time of entry into the state was accompanied by a tuberculin test chart, authenticated by the chief live stock sanitary official by whatever name known of the state from which the animal was brought, showing that the animal had originated in a herd under state and federal supervision, and that such herd, including the animal in question, had been subjected to a tuberculin test under the regulations of the accredited herd plan and had passed such test negatively within one year preceding the order of destruction.

A careful study is being made of animals showing slight reactions to the tuberculin tests, and special report forms are being used by field veterinarians on which to report such animals. The following table shows the result of postmortem of 909 animals condemned on slight reactions to tuberculin tests July 1, 1926-Nov. 1, 1927.

Herds tested	592
Cattle tested	13,308
Total reactors	3,557
Slight reactors	909

Reacted to Ophthalmic and Intradermic	Post-Mortem Results	Reacted to Intradermic Only	Post-Mortem Results	Reacted to Ophthalmic Only	Post-Mortem Results	Recapitulation	
						Total Number of Slight Reactions	Post-Mortem Results
385	Gen. 21 Loc. 268 NVL 96	113	Gen. 12 Loc. 78 NVL 23	411	Gen. 19 Loc. 295 NVL 97	909	Gen. 52 Loc. 641 NVL 216

Results of Testing All Cattle in a Badly Infected Township

Brunswick Township Rensselaer County

Test	Date of Tests	Herds Tested	Cattle Tested	Re-actors	Per Cent	Infected Premises	Postmortem Results
Initial	Jan. 1, 1927 to June 4, 1927	258	3344	1976	59	169 (65.5%)	Gen. 229 (12%) Loc. 1705 (86.6%) NVL 27 (1.4%)
1-0							

Reduction in Percentage of Bovine Tuberculosis

May, 1918, to Nov. 1, 1927

County	Approximate % of Bovine Tuberculosis May, 1918	Estimated % of Bovine Tuberculosis Nov. 1, 1927
Hamilton	2.8	0.1
Warren	5.7	0.3
Yates	6.2	0.3
Essex	7.2	0.1
Steuben	7.3	0.4
Schuyler	7.4	0.2
Allegany	8.8	0.2
Cattaraugus	15.3	1.0
Clinton	17.0	2.0
Chautauqua	19.0	1.0
Wyoming	20.8	1.5
Tompkins	22.2	1.5
Oswego	24.4	2.0
Livingston	25.6	1.4
Greene	25.9	1.0
Monroe	27.3	1.5
Genesee	28.4	2.0

Status Tuberculosis Eradication

Nov. 1, 1927

	July 1, 1921	*Nov. 1, 1927*
Accredited herds	123	43,120
Cattle represented	3,797	409,444
Herds passing first clean test	2,128	41,898
Cattle represented	30,920	303,222
Infected herds	1,907	15,993
Cattle represented	85,796	210,796
Total herds under plan	4,158	101,011
Cattle represented	120,513	1,033,095
Total herds in State (approximate)		176,000
Total dairy cattle in State		2,016,000

Modified Accredited Counties

New York has seven accredited counties, Essex being the first in New York and also the first in the Eastern States. New York's seven accredited counties and date of accreditation are:

Essex	Oct. 15, 1924
Steuben	Jan. 4, 1926
Allegany	Oct. 1, 1926
Hamilton	Dec. 1, 1926
Warren	Oct. 1, 1927
Yates	Oct. 1, 1927
Schuyler	Oct. 1, 1927

Combination Tuberculin Test Demonstrations

During the past few months, thirteen combination tuberculin test demonstrations have been held throughout the State. The plan is to hold these demonstrations in a zone composed of a number of counties. All veterinarians residing in that zone are invited to be present on the day the readings are made, and each veterinarian is given the opportunity of making and recording his readings, after which a large chart is displayed showing the readings, as we think they should be.

These demonstrations have resulted in increasing the efficiency of the field veterinarians, and uniformity in the classification of the reactors. Following these demonstrations, postmortem is made upon one or more reactors, giving the veterinarians an opportunity to observe the proper manner in conducting postmortem examinations upon reacting cattle.

Plans are also under way to hold demonstrations of this kind for the benefit of interested dairymen, giving them the opportunity of seeing the tuberculin test applied, the appraising of reacting animals, and observing the postmortem examination of cattle that have reacted to the tuberculin test.

There is an increased demand for these demonstrations and it is our intention to continue them in the future.

Appropriation of Funds for Indemnity Purposes

Fiscal year 1918	$ 260,000.00
Fiscal year 1919	190,000.00
Fiscal year 1920	200,000.00
Fiscal year 1921	953,819.22
Fiscal year 1922	1,278,387.61
Fiscal year 1923	5,000,000.00
Fiscal year 1924	3,000,000.00
Fiscal year 1925 (Last 6 months)	2,000,000.00
Calendar year 1926	3,500,000.00
Calendar year 1927	3,250,000.00
Total	$19,632,206.83

Essex County has a cattle enumeration of 17,117. This county was re-accredited during October of this year, 26,900 cattle being retested in the three-year period.

The splendid progress made has been due largely to ample appropriations by the legislature. For the next four to five years, it will be necessary that these large appropriations be continued, but after that period there will be a rapid decline in the amount needed.

In a few paragraphs, I have endeavored to point out that bovine tuberculosis can with certainty be eradicated under the area plan. I have also pointed out the progress, expressed in figures, that has taken place in New York within a few years. This progress is due to the cooperation of the cattle-owners and to the splendid efforts put forth by the members of the tuberculosis committees, the farm bureaus, granges, county health officers, boards of supervisors, and various civic organizations; also to the splendid cooperation and untiring efforts of the federal, state, county and accredited veterinarians.

If our present plans and policies are allowed to prevail, supported by the present cooperation and enthusiasm, New York will be entirely once-tested by the close of the fiscal year 1933, twice-tested by the year 1934, and accredited by the year 1936.

DR. FAULDER: I want to point out another important factor in bringing this progress about. In New York State we have perfect cooperation between the federal authorities and the federal representative. All these plans I have told you about are worked out by state and federal officials. They are all agreed upon and put into operation. That is cooperation. We have perfect teamwork, and when you have teamwork, you pull together and get the job done.

I want to spend just a few minutes in calling your attention to what is known as our progress map. We have these progress maps distributed, at the present time, to something like 150 points in the state of New York. They are colored. The pink represents areas where all the cattle have been once-tested. The brown represents areas where all the cattle have been twice-tested. The blue represents modified or accredited county. These maps are hanging in at least 150 offices.

On the first of each month printed instructions are sent out. These townships are also named and numbered, and each county is directed to change the coloring, according to instructions. Each county knows what the other county is doing. We have a little rivalry going on all the time. Each county is anxious to complete the work.

. . . Dr. Faulder then exhibited one of the maps. . . .

PRESIDENT VAN ES: We will now have a paper by Dr. L. Enos Day, "Tuberculosis of the Skin in Cattle."

. . . Dr. Day then read his paper. . . .

SKIN LESIONS IN TUBERCULIN-REACTING CATTLE

By L. Enos Day, *in Charge, Pathological Laboratory*
Bureau of Animal Industry
U. S. Department of Agriculture, Chicago, Ill.

It would be inadvisable for me to present the following results of experimental work conducted on the so-called skin lesions of tuberculin-reacting cattle without first giving a brief summary of the subject of skin lesions of tuberculosis in cattle which have reacted to the tuberculin test.

The subject of skin lesions in general has evoked so much controversy that I fear you would become bewildered should I omit calling attention to some of the literature pertaining to this subject before presenting the results of my experimental work. Before proceeding, however, allow me to emphasize an important point. All who have examined skin lesions microscopically have found acid-fast bacilli which resemble those of tuberculosis in a large percentage of cases.

The writer was the first to call attention to skin lesions in tuberculin-reacting cattle. In 1921[1] he examined, at autopsy, eighty-five such reactors and found skin lesions, either alone or in combination with other lesions, in forty-seven (55.3 per cent) of them. In nine of the forty-seven showing skin lesions the lesions were confined to the teats. The others were located in the skin covering the legs, and the sides or that portion of the body which comes in contact with manure while cattle wade or lie in it.

Traum,[2] in 1923, reported cases in California which, according to his description, resemble very closely those under discussion. From one of these cases he was able to procure a pure culture of acid-fast bacilli. He believed his cases to be lymphangitis in cattle caused by acid-fast bacilli. Beach and Hastings,[3] Calmette,[4] Carpenter and Goldberg,[5] Marsh[6] and others have since called attention to skin lesions in tuberculin-reacting cattle.

The percentage of skin lesions found in various parts of the country varies greatly. It ranges from 5 to 10 per cent in some localities to as high as 50 or 60 per cent in other localities. From personal observations made in various parts of the country, I believe that this variation is in direct proportion to the sanitary condition of the premises where the cattle are kept. In one

location where the reactors showed 60 per cent of skin lesions without other lesions, I found that the animals were not given any bedding to lie on in the stalls. The manure from the stalls was shoveled out into the barnyard, where it was allowed to accumulate for many months, making it necessary for the cattle to wade through this manure on entering and leaving the stalls. Naturally, under these conditions, the legs and such parts of the body that come in contact with the ground while the animals were lying down soon become heavily caked with manure, which is allowed to remain upon the animals. It is my personal belief that such accumulations of manure on the skin produce irritation and inflammation which lead to the formation of fissures in the skin through which tubercle bacilli gain entrance from infected manure.

Skin lesions of tuberculosis are found not only in tuberculin-reacting cattle, but are also prevalent in steers and cows received for regular slaughter at the various packing-houses. Dr. Herman Busman, while Inspector-in-Charge of Meat Inspection at Omaha, Nebraska, some years ago, inspected the hides of 10,000 cattle on the regular kill and found 134 cattle affected with skin lesions. This represents 1.34 per cent in animals with no other lesions.

Skin lesions are found in those places on animals that come in contact with manure while either standing or lying in it. The lesions appear as nodules and vary greatly in size. Some are barely perceptible upon close examination, while others coalesce and form lesions several inches in diameter. They may be located in the true skin or in the connective tissue just beneath the skin. In many cases there is a fistulous opening in the skin which discharges pus. This is especially true in cases where the true skin is involved. In a few of these cases the fistulous tract has healed and only a scar remains. In all cases where the true skin is involved there is thickening of the skin in proportion to the extent and duration of the infection. In many cases of comparatively long standing, caseation or calcification has taken place.

Those lesions which are located in the connective tissue immediately under the skin also vary in size, and are usually spherical in outline and contain a very thick, yellowish or reddish-gray-colored, tenacious pus, which often contains calcareous granules. These lesions, when sufficiently large, may be felt through the skin when palpated, as movable, spherical

masses. They may be single or multiple in number. When multiple, they are usually found forming a chain along the principal lymph-channels on the legs or on the sides of the body. Frequently lesions are found in the connective tissue of the teats of cows when incised.

In a very large percentage of skin lesions examined microscopically by us, at least 60 per cent have shown acid-fast bacilli. These bacilli resemble the bovine type of tubercle bacilli found elsewhere in the body, with the exception that some shorter forms are found which stain more evenly, although beaded forms are occasionally seen. Attempts to cultivate these organisms have been uniformly unsuccessful, with the exception of two instances: Traum,[2] in 1923, was successful in growing a culture of organisms from lesions of the skin of cattle corresponding to the above. Dr. Danes,[7] of the University of Utah, also was successful in obtaining a growth of acid-fast bacilli from skin lesions in cattle in 1922. Neither of these cultures proved pathogenic for laboratory animals. Marsh[6] examined sixty teat lesions in reacting cattle in which he demonstrated acid-fast bacilli in forty-five, or 75 per cent of the number examined. Six of these cases were cultured, but no growth was obtained.

In the branch pathological laboratory in Chicago, where about 200 cases of skin lesions in cattle have been examined, of which cultures on Petrof's medium were attempted in approximately 50 per cent of the cases, none have ever been obtained. An equal number of guinea-pig inoculations also have been made. In the beginning of this work we invariably sacrificed the inoculated animals at the expiration of twelve to fourteen weeks. On autopsy of these animals no lesions of tuberculosis were noted. In all cases, where cultures and guinea-pig inoculations were made, acid-fast bacilli had been found in smears made from the lesions.

The absence of lesions in our inoculated animals at the end of three months led us to believe that the bacilli in these skin lesions might possibly have been reduced in virulence while growing in the skin. Therefore, we decided to let future inoculated animals live a longer length of time before sacrific ng them. With this thought in mind, guinea pigs subsequently inoculated were found to be apparently normal upon physical inspection and palpation three months after inoculation, and were allowed to live for possible future development. Five months after inoculation it

was found that some of the inoculated animals had enlarged lymph-nodes. On autopsy, typical lesions of tuberculosis were found, not only in the enlarged lymph-nodes, but in the liver and spleen as well, in which acid-fast bacilli were found. In some of the other inoculated animals enlarged lymph-nodes were not detected until six or seven months after inoculation. Autopsy findings in these also revealed tuberculous lesions.

Cut and stained sections of many of these skin lesions received at this laboratory were prepared, and in each case, with no exception, histopathological changes of tuberculosis were found.

Since skin lesions in reacting cattle were first reported, there has been a doubt in the minds of some whether these lesions were actually caused by the *Mycobacterium tuberculosis* or by some other acid-fast organism. In order to shed some light on this question and remove the doubts in the minds of those who entertained such doubts, animals other than guinea pigs were used in the following experiments:

September 25, 1925, four five-months-old calves and four pigs of about the same age were inoculated with a suspension made from skin lesions from four cattle which had reacted to tuberculin, and in which, on postmortem examination, no other lesions were found. In each skin lesion used for inoculation a large number of acid-fast bacilli were demonstrated microscopically. The lesions were typical of those previously described. Each calf received about 5 cc and each pig 2 cc of a suspension prepared by finely grinding material from the skin lesions in normal saline solution and filtering through a single layer of cheesecloth. The inoculations in the calves were made into the subcutaneous tissue over the shoulder. The inoculations in the pigs were made directly into the superficial inguinal lymph-node. The inoculated animals were slaughtered six months after inoculation. No lesions simulating tuberculosis were found on autopsy in any of them. Each of the calves and pigs was tested with tuberculin before inoculation, and about three months afterward and again just before slaughter, and were negative to each test.

Feeling that perhaps the organisms were either dead or were of such low virulence that they could not produce disease, the test was again repeated. At this time calves only were used.

February 24, 1926, six calves about six months old were secured and tested with tuberculin. Each calf was negative to the test. At the time the calves were secured they were tagged by placing metal tags in the ears for identification, the tag numbers being

638415, 416, 417, 418, 419 and 420. March 20, 1926, calves 416 and 417 were inoculated. April 17, calf 420 was inoculated. April 23, calf 418; April 24, calf 419, and April 26, calf 415 was inoculated. In each case about 10 cc of a suspension of necrotic material from a skin lesion in normal salt solution was injected into the subcutaneous tissue over the shoulders. The skin lesions furnishing the material were from cows that had previously reacted to the test, with one exception, which will be referred to later, and on autopsy no other lesions were found. The exception was in calf 417. The cow which furnished the skin lesion in this case had previously been tested and was again tested just before slaughter, and failed to react to any of the tests. She had a rather broad thickening on the outside of one front phalanx, which was believed to be a skin lesion. Since she was not pregnant, and originally came from an infected herd, the owner readily consented to send her to slaughter. Upon autopsy the thickened area proved to be a skin lesion. There also was an abscess on the side of the animal, and the iliac lymph-node on the same side contained pus.

In all of the above skin lesions which were used for inoculation, including the last mentioned, acid-fast bacilli were found and guinea-pig inoculations were made.

May 25, 1926, all experiment calves were tested with tuberculin. Calf 417 gave a positive reaction; all of the others were negative. July 13, all experiment calves were again tested with tuberculin. Calf 417 again gave a positive reaction, while all the others were negative. October 11, another test was made, and at this time all the animals were negative. A final test was made, November 13, and again all were negative.

All of the calves were slaughtered, November 18. At autopsy all were found free from tuberculosis with the exception of calf 417, which had reacted, May 25 and July 13. In this calf the anterior mediastinal lymph-node contained a well-marked tuberculous lesion, which was the only lesion found in the carcass. The site of inoculation under the skin in each calf was carefully examined, but no abdominal changes were noted. The lesion in the anterior mediastinal lymph-node above referred to was found to contain a large number of acid-fast bacilli. From two or three to twenty-five or thirty acid-fast bacilli could be counted in each microscopic field. On the following day seven guinea pigs and one rabbit were inoculated with material from this lesion in the mediastinal lymph-node. All of the guinea pigs and

the rabbit died between January 8 and 27, or from fifty to seventy days after inoculation. At autopsy the rabbit and each guinea pig showed typical lesions of tuberculosis, and acid-fast bacilli were found in smears prepared from the lesions in each animal. There is no doubt in my mind concerning this case. I believe that the skin lesion from which the material was collected to inject into the calf was caused by tubercle bacilli of the bovine type, and that the lesion of tuberculosis found in the calf on autopsy was the result of the inoculation.

In our opinion all of the skin lesions found in cattle that give a positive reaction to the tuberculin test, and in which acid-fast bacilli are found, are tuberculous lesions caused by the *Mycobacterium tuberculosis* which has gained entrance in the skin through abrasions, because we know of no other acid-fast organism capable of producing such skin lesions, and at the same time giving a positive reaction to tuberculin.

However, much work is yet to be done along this line and time may prove that these experiments are not absolutely final, because the blazing of the way has barely started.

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. . . Dr. Day then showed some lantern-slides of cattle with skin lesions of tuberculosis. . . .

PRESIDENT VAN ES: I will call for the paper by Dr. T. S. Rich, on "Practical Methods of Eliminating Tuberculosis from Farm Poultry Flocks."

. . . Dr. Rich read his paper. . . .

PRACTICAL METHOD OF ELIMINATING TUBERCULOSIS FROM FARM POULTRY FLOCKS

By T. S. RICH, *Lansing, Mich.*

Inspector-in-Charge, U. S. Bureau of Animal Industry

The subject assigned to me, by your Committee, for discussion at this conference—"Practical Methods of Eliminating Tuberculosis from Farm Poultry Flocks"—concentrates our attention directly upon a problem which has been receiving a share of our interest for several years.

From the earliest days of our bovine tuberculosis eradication campaign in Michigan, we have been receiving communications from owners of poultry flocks concerning avian tuberculosis in their flocks. Requests for information and assistance have become more numerous each year, which would indicate, if we possessed no other data, that tuberculosis in our poultry flocks was spreading rapidly in Michigan.

In 1922 we requested our field inspectors to report all infected flocks with which they came in contact while conducting tuberculin tests upon cattle in their regular line of duty. Inspectors were not instructed, at that time, to make an inspection of each flock upon the farms they visited.

The Chief of the Bureau advised, in September, 1923, that information was desired relative to the percentage of swine tuberculosis which existed in an area free from bovine infection; also the percentage of the same infection existing in an area where the bovine tuberculosis eradication project had not been inaugurated. In obtaining the requested information we took the opportunity to gain further knowledge concerning the type of infection of swine in those areas.

The result of this investigation was of much interest to us, as it appeared quite conclusively that a large part of the infection with which we were dealing in swine was of the avian type and, furthermore, that, in some parts of our State, at least, the percentage of poultry-flock infection was high.

As we were now fully convinced that a campaign of education concerning this disease should be inaugurated, a form to be used by our field inspectors was prepared and the following letter of instructions was forwarded to each of our inspectors, on November 1, 1924.

> Owing to the rapid and alarming spread of tuberculosis among fowls and also to the fact that it has been determined that a large percentage of swine tuberculosis in Michigan is of avian type and is contracted from chickens, it has become necessary that we obtain data covering the extent of this avian infection in order that a campaign of education be inaugurated. With that end in view forms have been printed for obtaining "Information Relative to Poultry Flocks," a supply of which is being forwarded to you under separate cover and you are requested to make an inspection of the poultry flocks and to obtain the other information desired from each herd owner that you visit, sending the reports to this office each week with your regular reports.
>
> You are also expected to advise owners of diseased flocks in keeping with the instructions upon the forms."

Upon the weekly receipt of these reports from our inspectors, a letter was addressed to the owner of each flock where infection had been found through postmortem examination of suspected

fowls, giving further information concerning the methods advisable in cleaning up his flock and premises. We also inclosed with each letter a copy of Farmers' Bulletin No. 1200, "Tuberlosis of Fowls." This survey from Nov. 1, 1924, to date has given us the names and addresses of over 5,000 owners of infected flocks with whom further contact has been made possible through correspondence and bulletins.

After carrying on this flock survey for a time, it became apparent that the educational value connected with this plan was considerable. Therefore, in October, 1926, we revamped our plan of field reports in order that at least a second visit might be made to the infected poultry farms at the time a retest was being applied to the infected cattle herds in each county. This was for the purpose of obtaining data that would indicate how many of these flock-owners were following our advice. To date we have reports covering the second visit to 286 infected poultry farms which were located in three counties, namely, Allegan, Kalamazoo and Tuscola, indicating that 173 (60 per cent) of these owners of infected flocks were following our recommendations, while upon the remainder (113 farms) nothing had been done. However, we believe that following this second visit, many of the delinquents will see the necessity for action and the final result from this plan will show at least a 70 per cent improvement.

It is well understood that this survey brings us into close contact only with flock-owners who have clinical cases in their flocks. However, as those infected flocks are well scattered over the infected portion of our State, we feel that the education of these flock-owners, and the clean-up work which they are doing, will greatly assist in spreading desired information throughout the neighborhood in which these farms are located.

It is our judgment that in approaching a problem of this magnitude we should possess all possible information. Therefore, during the past several years we have endeavored to learn not only the extent of avian infection in Michigan, but also the manner in which it has spread from flock to flock.

To this end a questionnaire, containing most important questions concerning the manner in which it was believed the infection had gained entrance, was sent to more than 2,000 owners of infected flocks.

To date we have received 695 replies stating that additions had been made to their flocks, as follows: through the purchase of

cockerels, 419; purchase of setting hens, 36; purchase of chicks (from one day to six weeks old) from commercial hatcheries, 240.

In our survey covering the State we learned from visits to commercial hatcheries that the owners were not wholly concerned in the production and sale of day-old chicks but that many of them had a large and fast-developing business in the production and sale of well-bred pullets and cockerels six and eight weeks old. These young birds are kept largely upon the hatchery premises. Their food includes infertile eggs, taken from the incubators, which are fed raw.

It was also determined from our field survey that this poultry infection in Michigan is largely confined to the southern part of the State. It has also been found that the spread of infection has been keeping pace with the flock-improvement campaign which has been in progress over the southern part of the State for the past few years—a campaign in which the progressive flock-owner has been induced to improve his flock through the purchase of better-bred fowls from outside sources. In the northern part of the State such additions as are made to the flocks are usually from neighboring flocks. So far as we have been able to determine, the few infected flocks which we have located in the northern part of the State have been owned by the more progressive poultrymen who have endeavored to improve their flocks through the purchase of better-bred fowls, either from the southern part of our State or from other states.

You will note that up to this point we have made little mention of recommendations concerning the methods to be employed in eliminating this disease from the farm flock.

In Michigan we have two problems: the isolated infected flock of the North and the areas of extensive flock infection in the southern counties. To control or eliminate the disease in either case we believe will require a campaign of education, which, of course, is far more simple to put into effect with the isolated flock-owner than in the extensively diseased area. It is our judgment that the degree of success in all disease control is measured by the extent and kind of educational work carried on in connection with the control project. Or, in other words, education is the foundation necessary to all successful disease control work. Therefore, the first step to be taken in eliminating this disease from the farm flock is to enlighten the owner as to its nature and the steps necessary to be taken to save his poultry business from total destruction.

The plan to be adopted depends to some extent on the kind of flock with which we are to deal. If the flock is made up of valuable pure-bred birds, we would advise the application of a tuberculin test. Then, if it is found that the extent of infection is not large, all reacting birds should be removed, followed by a thorough cleaning and disinfecting of the premises. All additions to the flock, either through hatching or purchase, should be kept upon clean ground as far removed from the old flock as possible. A tuberculin retest should be applied every six months to those fowls remaining in the original flock until either a long time has elapsed without reactors, or the entire flock has been disposed of.

If it is the average farm flock with which we are dealing and infection has positively been identified, the only practical method is to consider the entire flock tuberculous. The owner should be advised to kill and burn all suspicious fowls found each day and to keep houses, pens and yards clean until the end of the first egg-producing season, when the entire flock should be disposed of. Then, after a thorough cleaning and disinfection of the premises, a new flock may be built.

Now, the methods mentioned in eliminating this disease from the farm flock are, we believe, successful and, if carefully put into effect, will go far in removing the trouble.

However, we have only now reached the point where the pinch begins. We have induced the owner to dispose of his diseased flock and now he is asking, "Where am I to procure birds known to be free from tuberculosis for the purpose of rebuilding my flock?" The more extensive our experience the greater the hesitancy upon our part in giving advice in regard to the purchase of replacement fowls. Although we have been but for a short time offering advice relative to disposing of diseased flocks, we are now hearing from persons who counseled with us that their replacement fowls are quite as badly infected as those that were removed.

These statements from poultrymen prove conclusively that it will require several annual flock changes to obtain the desired result in all cases. They also impress upon us the absolute necessity of preventing the sale of fowls for flock-building that are not known to be free from tuberculosis.

In conclusion, let me repeat that we have brought forth no new or original methods for the elimination of tuberculosis from poultry flocks. It is our belief that the well-known methods now in use are effectual if carefully followed. However, if steps are not promptly taken to control the source from which this

infection is disseminated, success will in no wise follow the most thorough or painstaking clean-up of the individual farm poultry flocks.

PRESIDENT VAN ES: No doubt all of you who were here two years ago will remember that on the floor of this assembly there was made a distinct contribution to the knowledge of tuberculosis by a gentleman working largely, at that time, with wild animals in captivity. We again have the privilege today to listen to a contribution which I think will not be less valuable than the one we listened to two years ago.

It gives me pleasure, therefore, to introduce this speaker, Dr. Herbert Fox, Professor of Comparative Pathology of the University of Pennsylvania. (Applause)

DR. FOX: Mr. Chairman, I want to thank the President and the members of your Committee for again inviting me to speak before you. I appreciate the privilege of bringing here some of the work on comparative pathology that we have been trying to do at the Philadelphia Zoological Garden.

. . . Dr. Fox then read his paper. . . .

SOME OBSERVATIONS ON THE DEVELOPMENT OF PULMONARY TUBERCULOSIS IN LOWER ANIMALS AS COMPARED AND CONTRASTED WITH SIMILAR LESIONS IN MAN

By HERBERT FOX, *Philadelphia, Pa.*

Professor of Comparative Pathology, University of Pennsylvania, and Pathologist to the Laboratory of Comparative Pathology, Zoological Society of Philadelphia

The most conspicuous and important manifestation of infection with the tubercle bacillus is that which occurs in the lungs. For this reason it is natural that much study and experimentation should be directed to explain why this tissue is so receptive of the virus, how it becomes diseased, the route of infection, the anatomical and physiological response to the morbid agent and the course of the changing processes. Closely related, and really an inseparable part of all of these, is the opposition offered by the body, known as disposition, predisposition, resistance and immunity. In the course of investigations, especial attention has been directed toward discovering whether these features of what has been called receptivity vary at different times of life, with the result that early in the history of the disease it was apparent that the youthful animal has the greatest receptivity and is seldom immune. Starting from this knowledge there have arisen several theories as to the date of origin of all pulmonary tuberculosis in man, but especially that form usually called pulmonary phthisis, so well known to occur in late adolescence and early maturity.

The studies that form the basis of this paper were undertaken to discover if anything could be learned in this direction by careful analysis of tuberculosis in wild animals, especially those zoologically related to man. It is, however, desirable, before describing the material, method of study and the peculiarity of tuberculosis in different varieties, to discuss the creditable theories as to the date of origin and the events that lead up to recovery or death from the disease.

At this place there may be mentioned briefly that the methods of introduction of the tubercle bacillus into the body of the lower animals are identical with those believed operative for man. Without entering the discussion as to the relative importance of the respiratory versus the alimentary pathway of infection, it can be stated that there is ample evidence that both are followed in the lower mammal as in man; my own figures would make them about equal for wild animals.

It is impossible to lead up to the subject of the time of infection and the theories that would explain it, without stating in a few words how the infection gets to the lungs. Tuberculosis does not behave exactly as acute infections usually behave, and it is nearly always impossible to determine the time of exposure that results in successful implantation of the germ. The entrance of the bacilli with dust and atomized saliva and sputum seems not a difficult matter to accept, since the direct penetration of the bacilli to the lungs has been followed.[1] Anthracosis of the lung and its related lymphatic tissue must be explained in the same way. The often greater extent of tuberculous lesions in the lung has been taken to indicate the origin there, but it is quite possible that a massive lesion may exist at a secondary deposit, a trifling one at the immediate atrium. Nor does the almost invariable involvement of the lymph-nodes about the bronchi and trachea help much, for this tissue is one for which the bacillus has an especial predilection, notably in youth, as it almost never escapes without morbid changes, no matter how the germs enter. The settling of tubercle bacilli on the mucosa of the bronchial wall may be followed by their penetration to the rich lymph-vessel plexuses that ramify through the lung and along which they may be carried by phagocytes or by the lymph-current. As we shall see, tuberculosis, of youth at least, is a disease of the pulmonary tissue, and of the lymph-nodes; these foci may or may not be related in the matter of lymph drainage. It is possible that on some occasions bacilli penetrate via the lymphatics to the blood

circulation and are redistributed to the lungs; but this cannot be the rule. There might be mentioned in this connection that experimental hematogenic infection results in tubercles at the edges of the lungs and beneath the pleura, the lymph-nodes and middle pulmonary parenchyma often escaping.

The alimentary tract would seem very important as an infection atrium, especially in the lower animals that lick objects soiled by the discharges of other infected ones. Tubercle bacilli certainly can enter the intestinal wall and perhaps leave no trace at the point, but the drainage line would contain evidences of their action. Von Behring's theory holds as a strong point this traceless entry, especially in infants, when the mucosa is incompletely formed and very permeable. Once within the body the path followed would lead to the venous circulation rather than to the bronchial and tracheal glands and the pulmonary parenchyma.

With these brief statements of the two sides, let us pass for a space to the question of how receptivity influences the events that follow invasion. It has always been accepted that if an affected animal be very susceptible, progressive degenerative and caseating lesions arise. On the other hand, resistance is expressed by fibrosis and calcification. It is acceptable that tuberculosis in human youth, in very susceptible adults and in certain sensitive lower animal varieties, proceeds rapidly to the formation of degenerative inflammations or large caseous masses. So definite a picture does this present in young children and so much does it resemble the disease in monkeys that the pathological complex has been called "monkey tuberculosis." So, too, one finds repeatedly quoted in literature the susceptibility of aborigines (Indians, Esquimaux) to the tubercle bacillus, the morbid lesions in them resembling the just-mentioned groups. So definite is this idea that, when the lesions do not progress thus, resistance or immunity is predicted. Is such lack of response to the tubercle bacillus a natural one, or one due to previous infection and the development of a certain grade of immunity? Many sides of this part of the subject are open for thought.

The natural response is based on what is termed disposition and differs in different animal orders and even in different members of closely related species. This applies not only to actual incidence of disease but to the form in which it develops. Thus, for example, certain breeds of cattle are less susceptible than others. South American monkeys are definitely less susceptible than are African varieties, although more often used as household

pets. The American opossum, an occasional pet, is resistant to tuberculosis, while the disease has, to my knowledge, not been seen in its ordinate relative, the kangaroo. Many other examples might be given. The type of disease may be peculiar in other orders than Primates. Thus, for example, the nodular caseous or fibrocalcareocaseous masses of the Ungulata are well known, the domestic cow offering a good example. Chronic ulcerative lesions are characteristically found in the order Carnivora and in the Equidae.

If now one would study the tissue reactions of these orders and groups somewhat more intimately, the use of the classification of tissue resistance by Theobald Smith[2] may be of value. He states that the best evidence of tissue resistance is the giant cell; then in order he puts the following: (2) giant cell with an epithelioid mantle remaining pervious without necrosis and tending to sclerosis; (3) a larger similar process with caseation and calcification; (4) a group of tubercles due to unhindered bacillary growth forming a relatively large focus with the usual retrogressive (degenerative?) changes; (5) rapid and copious multiplication of bacilli within a focus with necrosis and multiplication of bacilli within a focus with necrosis and multiplication. Opie[3] suggests that cavitation may be an indication of resistance. Throughout all his work, to which extensive reference will be made shortly, Opie refers to fibrosis and calcification as resistance or immunity phenomena of individuals without making it peculiar to man.

Having recently reviewed many gross and microscopical preparations, having in mind the rules of Smith and of Opie, it appears that the order Primates below man exhibits certain very definite features that correspond to these observations. In the first place the bare giant cell is practically unseen in the monkey and ape. Caseation is common, while calcification is exceedingly rare. The chief anatomical lesion corresponds with Smith's fourth grouping—unhindered bacillary growth, few giant cells and degeneration. The susceptibility of these animals is further shown by the infrequency of cavitation or of that fibrogranulation tissue wall that makes a cavity possible.*

Still further analysis of the order Primates reveals that the families Simiadae and Cercopithecidae are most susceptible as

*The only active fibrous tissue formation known to the author occurred in a pair of monkeys that had received living tubercle bacilli as an immunizing measure by Dr. Gerald Webb; the fibrous reaction did not, however, greatly influence the outcome of the disease. There was no calcification.

to incidence and tissue reactions. The family Cebidae (South American monkeys) have inconspicuous yet well developed pulmonary lesions, but definite lymphatic disease. The incidence in this group is definitely lower than in the first two, but their lesions are firmly caseous. The lowest family of Primates (Callitrichidae or Hapalidae) have shown no tuberculosis in the fifty-seven specimens at our disposal.

If now we pass to the Carnivora, a very definite change of incidence and anatomy meets us. Tuberculosis occurs among the domestic carnivores with reasonable frequency (3-5 per cent among dogs, 0.5-2 per cent among cats, according to statistics). Among the wild carnivores it has been reported frequently throughout the world, and always with the same picture—a chronic ulcerative process which in the lungs characteristically forms large masses with fibrocaseation or with cavity, or with both. More closely studied, the tuberculous tissue is found to consist of epithelioid cells and small mononuclears with very few giant cells. The resistance of Carnivora to tuberculosis is surely not indicated by a large number of giant cells. Opinions differ as to their frequency. I have seen them several times. Douville states that they do not occur in dog tuberculosis. Calcification varies greatly; its presence may be sought in the pleural wall of dogs, but it has not been seen in our wild specimens. The carnivores, therefore, seem to lack two accepted evidences of resistance —giant cells and calcification, although they do not have great susceptibility to the disease as would be indicated by frequent occurrence or widespread degenerative lesions.

The order Ungulata presents very remarkable receptivity and resistance to tuberculosis. The domestic Bovidae show this although they are too closely associated to domesticity for us to accept them as representing what may be true for the wild ungulate. All varieties of this order receive the infection and their reaction is closely similar in all the families. Giant cells are numerous, fibrous tissue and caseation are almost invariable, calcification is the rule, and cavitation uncommon; this is a combination of characters that would indicate a marked resistance and yet, true healing or perfect limitation of lesions rarely, if ever, occurs.

The order Marsupialia is instructive for reasons already given and because we have observed two cases of the disease in the opossum, animals that had been presented from private sources and had lived in the company of human beings for several months.

These animals showed abdominal lesions only, caseous degenerative foci made up of soft granulation tissue with few giant cells. The lungs were not involved. Two cases were insufficient for general observations. It, however, seems noteworthy that among 324 autopsies upon marsupials, only these two cases should have been found, and in animals exposed closely to man.

The remaining zoological orders among the Mammalia have supplied too few cases of tuberculosis to permit of inclusion in this study. The response of the human being, having been most studied in regard to age, will be discussed in connection with Opie's work since the subject is put most concisely by this author.

It appears from the foregoing that the response of various animals is definitely peculiar to the groups. Certainly there is a difference in receptivity and in pathological prognosis between lower Primates and Carnivora, between Ungulata and Marsupialia. There is fair reason to assume that the lesions as they appear in a zoological collection are natural responses to first exposures since there is no evidence that tuberculosis exists in the wild, and therefore one cannot argue that the form of receptivity is modified by previous exposure. It has been repeatedly stated that the usual form of tuberculosis in man is due to the long standing of the disease among man and a certain grade of hereditary resistance or a survival of the fittest. In domestic cattle it has been assumed that the resistant animals have been kept, the poor ones killed, and a more resistant animal breed developed. Is it not reasonable to view both man and bovines as having a specificity of response to infection? How will the theories as to the time of infection help us and how will wild animal observations fit with those on man?

Tuberculous infection has been shown to exist in a very large percentage of individuals, Opie stating that 98 per cent of adults dying from diseases other than tuberculosis have healed or focal lesions somewhere in the lungs. The infection can be demonstrated by tuberculin tests and X-ray pictures of the chest in an increasing percentage as age advances. Infancy and youth are the age periods when the body is most receptive of the bacillus as has shown clinically and experimentally. The intestinal wall of the infant is easily permeable. Infection of human adults is apparently difficult, as indicated by the infrequency of marital transmission, and of evident contagion to the personnel of tuberculosis sanatoria. Inoculation of animals does not lead to a disease like human phthisis, which fact may be explained by

the varying natural reaction of experiment animals. Small doses of attenuated bacilli given repeatedly to certain animals may result in a lesion suggestive of human consumption. Inoculation of bovines always results in a typical bovine tuberculosis. An animal once infected with tuberculosis, if inoculated again, will experience no increase of his original focus of disease and at the site of the second injection will show an inflamed area that soon heals.

Using these accepted data, von Behring,[4] an ardent supporter of the theory that tuberculosis begins as an alimentary infection, devised the theory that all tuberculosis originates in infancy or childhood from contact with an infected person, or swallowing infected food. Infection passes via the cervical and mediastinal lymph-chain to the tracheobronchial glands and thence along the intrapulmonary septal channels to the apex. Or it may ascend from abdominal glands to the mediastinum or even penetrate to the circulation, thus to be distributed and to find its most favored locus in the apex. Sometimes these foci heal, at other times only remain latent. In later life under a variety of conditions, von Behring believes that these foci awaken to activity. It may be that the healing of the original foci is attended by an increased local and general resistance, but this is never complete enough and re-development may occur. At all events an animal or man reinfected with tubercle bacilli or experiencing an extension has a different reaction than on the primary occasion, the most notable difference being that primary tuberculosis is chiefly a lymphatic response, secondary lesions being more in the parenchyma.

This question of the time of infection has been dealt with in a series of papers by Opie.[5-11] The course of this work and the concluding theory may be summarized as follows:

Tuberculosis of infancy and childhood is usually a disseminated process within the parenchyma of the lung. It is always associated with lesions in the tracheal or bronchial glands. When the process is active and progressive, it is usually unicentric. Very young children show much caseation, while fibrosis appears in older children.

Adult tuberculosis is of two types. The first is a fibrocaseous ulcerative or perhaps calcifying process, usually at the apex and not associated with caseous lymph-glands. The second type is focal with circumscribed or limited masses scattered variously in the body of the lung and associated, sometimes directly, with

a caseous gland. They rarely exceed 1 cm. in size and may be single or in a localized group. This form is probably the unresolved lesion of infancy and youth, and increases in incidence so that, at thirty years, 85 per cent of people have these foci. Focal lesions are not related to the chronic phthisical apical lesions, either anatomically or by lymph drainage, for they may occur in opposite lungs. Focal lesions tend to heal, phthisical lesions do not. Opie suggests that the more evident the inactive focal lesions, the less active the apical phthisis. Focal lesions may occur at the apex where they produce a scar or fibrocalcareous mass in the lung tissue; pleural involvement is not necessarily tuberculous, but should be examined carefully.

Childhood tuberculosis forms scattered lesions in no particular part of the lungs, but always involves the parenchyma and, to repeat, is always associated with lymph-node lesions. While no tendency to heal appears early, as the child grows older, more and more calcific foci appear at places known to have been focal lesions. Between fifty and seventy years, over 90 per cent of all persons have calcified nodes in the lung proper. Intestinal tuberculosis usually leaves some traces in the abdominal lymph-drainage area and, where these are prominent, few pulmonary foci are found.

Opie thinks that the evidence at hand is amply convincing to accept the origin of intrapulmonary lesions by inhalation of germs and that they are more extensive than those produced by feeding tubercle bacilli. However, he agrees with Calmette and with Smith that the lymph-nodes may be attractive or non-resistant to tubercle bacilli which may set up a slowly progressive process that may later spread to the parenchyma of the lung. Slowly progressive lesions at any place may afford some resistance to secondary infection. "It is seldom if ever possible to demonstrate by anatomical examination, that apical tuberculosis of adults has spread from a focal lesion of childhood. . . . . Focal lesions which become encapsulated and tend to heal are not associated with cavity formation and do not cause the dissemination of bacilli." Tuberculosis lesions at the apex may go into a fibrous stage without cavity and are found in 15 per cent of persons not dying from tuberculosis. A puckered scar *in the lung* and pleura may be found in 22 per cent of such people. With all these apical lesions there are found numerous calcified foci scattered through lung and hilum glands and *the more numerous the scattered foci, the less active is the apical process.*

These calcific areas are more numerous in persons who have no active lesions, and who die from some other diseases, than where progressive tuberculosis coexists. As age advances, calcific areas become more numerous. Fibrocaseous areas of focal type show more tubercle bacilli than do fibrous scars. Fibrous scars at the apex may not have the microanatomy of a tubercle. Calcific areas rarely contain tubercle bacilli, but if focal or apical lesions exist in the lung, the bacilli are found in the lung tissue about the calcific areas.

As one examines bodies at all ages it seems certain that nearly every child has some tuberculous infection, that in adolescence focal lesions become increasingly more numerous, that apical lesions of a different sort unrelated anatomically also increase and that one can find every transition from healed to latent to fatal infection. Parenthetically I might interpose here that this is true in wild animals only in part and in one variety, the Ungulata, which have a very peculiar response to tuberculosis. Opie proceeds to state that experimental tuberculosis is similar to that in man only when the animal has been made somewhat resistant by preliminary infection, and the result then finds an analogue in adult apical human phthisis.

Opie has collected this formidable array of data by long study of extensive material which he has supplemented by Roentgen photography of lungs removed from the chest. By this means he has been able to discover the disseminated calcific foci in the parenchyma of over 90 per cent of persons not dying of tuberculosis. On the basis of his studies, Opie has evolved the following theory of the origin of that form of tuberculosis known as adolescent and adult phthisis.

Nearly every child is infected, many succumb; but if they survive, there remain foci in the lung that become calcified and the bacilli die off in the course of years. Some foci do not perfectly heal but remain as fibrocalcareocaseous or mortar-like masses, called latent focal lesions; these may later reawaken to activity. Adult apical phthisis is a secondary or superimposed infection, unlike juvenile tuberculosis, and is the result of the action of the tubercle bacillus in a person who has acquired resistance by recovering from infantile or childhood infection. When tuberculous infection occurs in an adult who has no evidence of having had juvenile lesions of a calcified or focal type, the resulting morbid anatomy resembles that seen in the disease of earliest life, and is quite rapid in its course. Opie, therefore, thinks the theory of

von Behring to be disproved, that adult phthisis does not date from childhood, but develops in an individual prepared by recovery from infection in youth.

Studies of a similar kind have been made by H. H. Scott,[12,13,14] He made his human observations on children of the Chinese who may be considered as presenting a very fertile soil for the bacilli. This observer emphasizes the wide distribution of juvenile foci. He shows further that juvenile foci are anatomically related to lymph-gland lesions, but indicates that this often implies a single or unicentric process. However, careful search will always reveal lymph-node lesions if intrapulmonary foci are found. This need not be true for adults. He concludes further that when the infection atrium is not in the respiratory tract, in the intestinal area, for example, the pulmonary disease is insignificant or may not exist; whereas when there is no other evident portal of entry than the lung, the lung shows the major lesions. Scott, in applying his knowledge to a study of wild animals, finds it difficult to decide upon the infection atrium, because in most varieties of animals, generalization occurs more rapidly than in man and the reaction or receptivity is quite variable. He states that since they are virgin soil, the progress is rapid, the course peculiar and there is no evidence of healing. He has seen calcification only in ungulates, never in monkeys, and he states in a letter that he has never seen what might be considered as evidence of healing in these latter animals. Carnivore tuberculosis, according to Scott, is parenchymatous and not lymphatic; this is also my experience. A revision of our carnivore tuberculosis reveals that only in the Procyonidae are the lymph-nodes always involved to any extent. Among the eight cases in the Ursidae, Felidae, and Viverridae, naked-eye lesions in lymphatic tissue are recorded only twice. In two animals, a jaguar and a bear, it is specifically stated that no lesions were found in the hilum glands in the presence of active bronchogenic nodular caseous tuberculosis.

The foregoing observations and theoretical considerations have been applied to a study of tuberculosis in the animals at the Philadelphia Zoological Garden with the hope that comparative study might throw some light upon the subject. The principal features that have been investigated are the evidence of healing, the existence of calcific, focal and advancing lesions, the importance of calcification, the relation of lymph-node and parenchyma lesions, the position of retrogressive and active lesions and the relative importance of alimentary tract infection. This last has

not been very satisfactory in result because of the reasons already credited to Scott. The manner of carrying out the investigation was modelled after that of Opie—the X-ray photography of excised lungs. The results have not been very satisfactory, but some points have been learned. I wish to register here my thanks to Dr. H. K. Pancoast and his associate, Mr. Jamieson, for their efforts to obtain successful pictures of these lungs. After removal from the body they were photographed as soon as convenient, being blown up by a bulb and catheter introduced into the trachea. The excised pulmonary tissue offers so little resistance to the X-ray that clearly reproducible pictures are not easy to obtain, but several excellent films have been available for study. This method being limited in usefulness and since every lung had to be carefully dissected, it was thought that very thorough slicing and palpation would reveal all the pathology in the lung, especially when supplemented by microscopic section study; this technic Dr. Opie approved as satisfactory to demonstrate calcified, focal and progressive lesions, if done thoroughly. Since beginning the study, we have had available 10 Primates, 1 Carnivora, 7 Ungulata. Besides these freshly dead animals, there have been found in our jars thirteen monkeys, two Carnivora, two Ungulata and one Marsupialia, all of which have been subjected to the same careful sectioning. A graphic lung-chart has been made of every pair of lungs when usable lesions were found. In addition, records and data from our postmortem protocols have been used when necessary; the two sources are quoted independently, since the method of study has necessarily been different.

1. Evidence of resistance: The criteria of resistance that tends toward healing will be fibroid encapsulation, calcification, cavity formation and giant-cell formation. Fibroid encapsulation is found only in carnivores and ungulates. It is never complete and tubercle bacilli in goodly numbers may be found in such foci. A fibrosis in a capsular form is characteristic of all lesions in the ungulate, except the rapid caseous pneumonia. Calcification, although to be mentioned in this heading, is appropriately discussed in full in the next two sections. Cavity formation is found in the carnivores, in the ungulate and, rarely, in the monkey. In the last-named animal, it should be emphasized, the cavitation is due to a removal of a large mass of recently produced necrosis and is not the result of slow ulceration and discharge, the space being surrounded by recent slough and not

by granulation tissue with exposed blood-vessels, a picture well known in the carnivore and in man. Chronic cavitation is, therefore, an expression of tuberculosis in man, carnivore and ungulate. Giant-cell formation, aside from miliary tubercles, was carefully sought in these monkeys and one ungulate recently dead, and in older sections of ten various members of all three groups discussed in this paragraph. No separate giant cells were found. More giant cells were found in the tuberculous tissue of ungulates and monkeys than in the tissues of carnivores.

2. The existence of calcified and focal lesions: As has been stated, calcification is characteristic only of the ungulates. Among the thirty-eight well-studied lungs, it has occurred once, in a raccoon, in the form of disseminated foci as described by Opie. These nodules did not contain bacilli or tuberculous histology, and as the animal showed no evidence of tuberculosis and no instances of the disease have been encountered in raccoons, one must consider them either multiple parasitic remains (which sometimes occur in these animals), which is probably correct, or as healed tubercles. In none of the monkeys was there calcification within the lungs or lymph-nodes.

Focal lesions were encountered only in monkeys and most definitely developed in the Old World varieties. The Cebidae, a family with low receptivity for tuberculosis, showed no calcification and no very clear focal lesions. However, in one example (*Cebus apiculatus*, Ch. 11*), there are older, somewhat limited caseous areas in the left lower lobe and left tracheal gland that might have been foci whence spread occurred. Among the ten Old World monkeys, there were four examples (1, 2, 4 and 8) of well-defined focal lesions with firm caseation, apparently older than the remaining tuberculosis lesions (Ch. 8).

3. Importance of calcification: Judging by the data just presented and by a study of our general material, calcification per se does not appear to be a very valid criterion of resistance to tuberculosis. Examination of the records of kangaroos and rodents failed to reveal its presence in healed foci and these animals have been in the collection in sufficient number, and have been as much exposed to infection as ungulates or carnivores. The calcium metabolism of animals in a menagerie is often in a state of unbalance and metastic calcification to the lungs might be expected. There are copious examples of bone dystrophy among our specimens, but calcium deposited in the lungs is not a prominent feature. However, in youthful animals, especially

*Refers to charts used by author in illustrating his paper. Charts not received for publication. Editor.

when infested with parasites or suffering from nonspecific respiratory infection, it is highly probable that calcium would be deposited at foci of irritation without implying that tubercle bacilli had started the nidus. This may be true for the human being in youth, when the food calcium is very rapidly taken up for growth purposes and might be deposited at irritated areas, or where there is high acid-concentration.

4. *Relation of lymph-node and parenchyma lesions:* Because of the rapid spread of infection in the lower animals, this relationship is usually difficult to follow. In the monkeys there was never a parenchymatous without a lymphatic lesion. In the four cases in which older focal areas were found, the lymphatic process was greater on the corresponding side. In two carnivores adequately described in protocols, the lower mediastinal rather than the higher tracheo-bronchial glands were affected. The data do not permit a statement that lymph-nodes were more or less affected with apical or disseminated processes, but the writer is satisfied that his experience would justify the statement that the more distributed the process within the lung, the greater the lymph-nodal involvement. The reverse, however, is not the case, for there can be large caseous lymph-nodes without discoverable parenchymatous foci. This is especially well shown in domestic cows.

5. *The relative position of retrogressive lesions to active lesions:* For this purpose especial attention was given to cases 1, 2, 4 and 8, that showed older focal lesions. In every case these were in close relationship to the acute or progressive processes. This would suggest but not prove the awakening of a dormant focus. Insofar as the exact locality of the oldest fibrous scar-like lesions were concerned, they were found six times in the cephalic lobes and six times in the caudal lobes. But this may be misleading, for the six cases with cephalic involvement showed nine spots, whereas the six caudal cases had thirteen spots. The caudal lobes are more often the seat of settlement of bacilli, especially in animals infected by the alimentary tract, and this may be the case in the above instances.

6. *Alimentary vs. respiratory infection:* Our already published figures[15] would indicate that these two routes are about equivalent in the wild animal. We may demonstrate by the use of charts 2, 3, 5 and 7 that alimentary tract infection is more definitely lymphatic and pleuromediastinal, while aerogenic infection enters the parenchyma of the lungs. Charts 2 and 7

are cases of animals almost certainly infected via the respiratory tract and show advancing parenchymatous lesions. Cases shown in charts 3 and 5 had very definite abdominal foci of considerable age and presented extensive lymphatic and pleural involvement with relatively little replacement of respiratory tissue.

7. *Pulmonary disease when the portal is elsewhere and when it is certainly in the respiratory tract:* This subject is partly answered by the foregoing heading. Studied from the standpoint of disposition of major lesions, the matter appears somewhat clearer. Among the thirty-eight animals recently studied, fifteen had active tuberculosis, and of this number nine had lesions that, by all the criteria we could use, were of respiratory origin. Of these nine, five had no gross lesions in the abdomen, two had moderate lesions in the spleen or liver or both, one had a large mesenteric mass and one had a small intestinal mass. This, taken with the data in heading 6, would seem to support Scott's contention of the prominence of pulmonary lesions in aerogenic infection and their inconspicuousness in alimentary infection.

Ordinate Tuberculosis in View of the Theories of von Behring and of Opie

The writer is aware that the extent of material closely studied in recent months is hardly great enough to justify conclusions in this direction, but ventures to presume that these observations with the records of the laboratory may afford some ground for thought and further investigation. The first difficulty that is encountered is in the difference between youthful and adult human tuberculosis and the similarity of the disease in all the specimens of wild animals at our command. Too seldom do we know the age of a specimen and we are compelled to note it as young, mature or old. None the less the lesions are certainly not enough different in young and old monkeys to have caused discussion of it in the literature. That there is a gradation from very rapid to very slow fatal infection is certainly the case, but this might be, and indeed is known to be, due to the presence or absence of concomitant disease of other kinds, to injury, to uncongenial mates and other reasons. Realizing the limitations of the argument, the different orders are to be taken up separately, since they exhibit differing pathologic responses. Only those orders are discussed that have had representatives in the autopsy material of recent months.

Primates: Tuberculosis in the lower branches of this order appears most in apes and African monkeys, less in New World

monkeys and not at all in marmosets, in our experience. It is a progressive process with little tendency to focalization and without any evidence that calcific nodules are to be formed. Because of these characters and rapid course, it fits in with both theories under discussion. There is no chronic ulcerative phthisis, which, according to Opie, would occur only if calcific deposits were present. It is both aerogenic and alimentary in origin, but because the pulmonary parenchyma is most involved when the aerogenic route is followed, less support is found for von Behring's alimentary theory. Tuberculosis in the Primate, therefore, seems to be explained as a recent direct pulmonary or alimentary infection, and its morbid characters support the theory of Opie.

During the last twenty-two years, every monkey in our collection has been tested with tuberculin and found negative before admission to the general collection. Certain apparently husky specimens with suspicious reactions have been put in an outside bandstand cage, where several have lived for many years. Some have died and some have interesting histories that are appended.

7201 Rhesus Macaque No. 197 ♂—Born, May 23, 1923. Parents unknown. Osteitis deformans of mixed type—hypertrophy with irregularities of epiphyses. No sign of tuberculosis—no gross scars in lungs. Born in and never left bandstand

3863 Rhesus Macaque No. 147 ♀—Received, July 10, 1911. Tested 6 times in 4 years, never giving a wholly unexceptionable chart, but passed to bandstand after second test with other not wholly satisfactory monkeys. Returned two months later, held and tested twice, being passed after three months at laboratory quarantine. Sent to the monkey house because this chart was her best. Unwise. Put in bandstand 4 months later, had a baby the following year (1914); both put in monkey house, where they remained about 1 year. Not in good condition, sent to laboratory, April, 1915; did not pass test, put into open cage by lake. To the laboratory again in October, 1915; did not pass, lake cage again. Died, Feb. 4, 1916. Autopsy shows recent active miliary lesions with older lesions in abdomen and in brain (chart 4).

3312 Rhesus Macaque No. 169 ♀—Received, March 17, 1914. Gave good temperature chart. Passed to bandstand, where she was exposed for a short time to 3863. Because others abused it, put in separate lake cage, August 5, with Rhesus No. 156. Died, Sept. 20, 1914. (Rhesus No. 156 died 2 months later—no tuberculosis.) Monkey tuberculosis of ordinary type, but not very extensive. Most prominent lesions are fibrocaseous and pyoid mediastinal mass and caseous cerebral mass.

4275 Rhesus Macaque ♂—Received, June 3, 1911. Gave two good charts. Bandstand, 6 years. Death from infected wounds. No signs of tuberculosis. Parasitic cysts under pleura. Much lymphatic anthracosis.

3121 Rhesus Macaque ♀—Received, April 10, 1913; died, Jan. 25, 1914. Adult. Passed good test. Bandstand only. Autopsy shows some fibrosis about bronchi with dilatation and circumferential fibrosis (hyaline) which all appears like a congenital bronchiectasis. (From notes it seems that these lungs were thoroughly cut and no scars found.) Animal had amebic dysentery.

3138 Rhesus Macaque No. 139 ♂—Received, June 3, 1911; died, Feb. 13, 1914. Several tests, most of which were not satisfactory. Exposed to Weeper Cebus No. 55—retested and was suspected, but put into band-

stand. After 2 tests, over a year, passed to monkey house where he died of colitis, possibly amebic. Lungs only fairly well studied, probably no tuberculosis scars; cyst-like areas with congestion, possibly parasitic.

Of these histories that of 3863 is most significant in showing that despite living four years after a suspicious reaction, most of the time out of doors, infection was slowly progressive and never healed, although it may have been latent for a time. Its young was not thoroughly sectioned, but gave no gross tuberculosis lesions. The remaining five animals gave suspicious charts, perhaps because of osseous or intestinal nontuberculous disease, but were without focal calcification or focal lesions to account for their freedom from active disease.

Carnivora: This order has pulmonary lesions that resemble most closely those of human phthisis. The distribution of the pulmonary lesions is, however, different in that the caudal lobes are definitely more affected than are the cephalic. Lymphatic drainage areas do not show caseous masses with the regularity of human youth. Calcification is not a characteristic of either a limited caseous mass or isolated foci within the parenchyma. There are few gradations of infection from latent to active, all of them appearing slowly progressive. Whether these animals are infected in youth or adult life can be only surmised. Respiratory lesions are the rule and lymphatic lesions inconspicuous. These animals are not especially gregarious, do not nose each other very much, but swallow whole, or nearly so, all they eat, and lick their surroundings. General evidence would suggest that they get the pulmonary infection via the alimentary tract, allow the bacilli to pass through the lymphatic system and settle in a place of vantage and produce a chronic process. Abdominal tuberculosis occurs, but is rare. There is no evidence that infection in youth and recovery therefrom lays a foundation for chronic ulcerative disease.

Ungulata: The fibrocalcareocaseous lesions of this order bespeak a very definite type of reaction. Evidence from all quarters credits the respiratory tract with the major role in the origin of infection, yet lymphatic tissue in these beasts is not only a filter, but a seat of very definite and characteristic lesions. This is likewise true of the serous membranes. Evidence that there are separated, healed, calcific foci is not to be found in seven examples of recent study, in nineteen tuberculous cattle recently posted, nor in our records. In our protocols lymphatic lesions outnumbered parenchymatous, and most of them were

frankly caseous. These data would not favor the origin of adult tuberculosis as a reinfection, but rather as a slow process in an animal of peculiar receptivity.

Marsupialia: The two cases of tuberculosis in this order exhibited lesions in the abdomen, the lungs being free. Emphasis can be placed only on the obvious alimentary origin, the freedom from active lesions of the lungs, the scarcity of the disease in marsupials and the fact that both these animals were presented from private sources.

Conclusions from these data upon this as yet controversial point seem unnecessary and perhaps unwise. One might with propriety state that both theories as to the date of origin of tuberculosis find support in the response of some animals to infection. Certainly the exact homologue of the history and anatomical development of tuberculosis in man is not found among the lower animals, so that great caution must be used in deducing from animal experimentation how the human disease arises. On the other hand, there is a strong similarity between tuberculosis in wild and in domestic Ungulata. On the whole, it seems best to consider that each order of animal exhibits a receptivity as a peculiarity—behaviorism, as the modern vogue would put it.

And this last thought may act as a summary of the text of this paper—ordinate receptivity or susceptibility is a very distinct feature of the disease tuberculosis. But one may with propriety go more deeply and show that zoological family receptivity is likewise important, perhaps more important than is ordinate. It is certainly true that some families of Primates are more susceptible than others and this is also true in the families of the orders Carnivora and Rodentia. Ungulata, to which the domestic cow belongs, show the same type of morbid lesions in all the families that have come to our attention, and we believe that all families are about equally susceptibile, even though some, Tapiridae, for example, have not shown the disease at our laboratory. The lesson to be drawn from these data is that lower animals behave in a definite manner when they meet the tubercle bacillus for the first time. There is no true healing, as occurs in man. Certain varieties of animals, the kangaroos for example, seem to have no receptivity for the bacillus.

Is the response of man due to a peculiar natural form of receptivity and resistance, is it an inheritance because the disease has been in the human race many centuries, or is it because the human

child meets the germ early in life and, if he overcome the attack, acquires a resistance? In the face of the facts that have been advanced here, the thought that the human being reacts in a peculiarly characteristic manner because he has a definite type of reactivity cannot be dismissed until we explain why the domestic and wild bovine react identically, the Carnivora react like adult human beings, and why certain Primates react like youthful human beings, and other Primates do not react at all. It seems, therefore, that indivdual peculiarity of an order, family or genus, must play a very large role in the inception, development and result of tuberculous infection. Infection early in life and a recovery therefrom will not explain chronic ulcerative tuberculosis in carnivores, chronic calcareocaseous lesions in bovines, nor will it satisfactorily settle variations in disposition in families of the same order. The types of disease are so peculiar to animal groups that the awakening of latent youthful infection, according to the von Behring theory, will not explain all the characteristics. Therefore, it would seem that human phthisis is a specific type of receptivity for the bacillus and not the result of acquired immunity, that the calcareocaseous morbid anatomy of bovines is peculiar to them, and so on through the groups.

These data would also strongly support the thought that infection may occur at any age and that the hygiene of animals must guard adults as well as young.

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PRESIDENT VAN ES: I am sure that all of you will agree that the Chair took no chances when he predicted that the second contribution of Dr. Fox would be equally as interesting and edifying as the one he made before. I hope Dr. Fox will come to us often and will stay here this afternoon to participate in our discussion and further deliberations on tuberculosis.

As you remember, it was announced this morning that one of the principal speakers was delayed. He is here now and, without any formalities, I want to introduce him, if he needs any introduction. It is Dr. Bundesen, whom we will always affectionately remember as one of the most outstanding health officers this country has produced.

. . . The audience arose and applauded Dr. Bundesen. . . .

DR. BUNDESEN: I appreciate that reception more than I can tell. I was asked this morning, "Now that you are no longer Health Commissioner, are you going to go over to address the members of the United States Live Stock Sanitary Association?"

"I will address those men any time. They have been the warm supporters of the things we have done. We work according to plan. It takes more than just a little bit of an upset to interfere with any of those plans." (Applause)

. . . . Dr. Bundesen then gave his address. . . . .

A CAMPAIGN FOR SAFE MILK

By HERMAN M. BUNDESEN, *Chicago, Ill.*

The outstanding accomplishments in improving the safety and wholesomeness of the city milk-supply during the past year include the following.

You gentlemen will remember that I appeared before you two years ago, that we had a battle on at that time to clean up. I told you we would do certain definite things, and that I hoped in a year or two I might again be called before you men to let you know whether the things we had said we were going to do were all hot air, or whether they really were things that could be accomplished. You have given me that opportunity. Two years ago I appeared before you and said that if it was the last damn thing I ever did, I was going to see that every drop of milk that was sold in the city of Chicago came from cows that were free from tuberculosis, and that no power this side of hell could stop me. It has been two years ago. I am now prepared to give you some facts and figures to show you what two years, plus a little intestinal fortitude, guts, have been able to accomplish.

1. The requirement that all milk sold in the City must be from healthy cattle was adopted and effectively enforced, without curtailing the supply or increasing the price to the consumer.

That is one of the arguments made, that babies would die right and left, and milk would be one dollar a quart, and it would be of inferior quality. It has not been one dollar a quart, it is still what it was two years ago—fourteen cents a quart.

The situation now can be summarized briefly as follows:

(a) An ample supply of milk from healthy cattle has been available throughout the year, in spite of dire predictions of a milk famine and resulting heavy loss of infant life.

(b) The price of milk to the consumer has not increased as predicted, but remains at fourteen cents per quart.

(c) Department surveys show that the consumption of milk has increased 15 per cent during the past two years, to a total of 1,500,000 quarts daily.

(d) Many farmers report that they are now securing more milk per cow from their healthy herds than before from diseased cattle and are fully convinced that the elimination of diseased cattle was necessary and beneficial to the dairy industry from a financial standpoint alone.

(e) Following the precedent set by Chicago, many other cities throughout the United States have made similar requirements, among them being Cleveland, Detroit, Milwaukee and Baltimore. Many of Chicago's suburban cities, such as Evanston, Oak Park, Cicero, Waukegan and Winnetka, whose milk supply was largely that rejected by Chicago, have adopted the same regulation requiring all milk to come from healthy cows.

2. Improved quality and further safeguarding of the milk supply at its source have been secured through increased inspection of dairyfarms.

In this connection I would like to say that is one of the big things that you men can do. We have cleaned up the cattle now. Tuberculin-testing is more in favor now than it has ever been in its history. What you men can help us do with your magnificent support is to clean up the source, clean up the barns, clean up the dirty places that they have, When a man cleans up his cows and his cattle, usually he cleans up the rest of it, the barns and places of abode, and the equipment, and is more sanitary. That is the one big message I would like to give you men today—to please help us continue this fight to put that over, in cleaning it up, and you men can help us wonderfully in this connection.

Also you can help us in building strong bodies in children and men and women, first, by seeing that a constructive publicity program is gotten out to show how safe all the milk supply is; and, secondly, to show what can be done to increase the consumption of milk by urging people to drink more milk, and, by example, to drink at least one quart of milk a day ourselves.

3. The proper pasteurization of all the milk has been secured by correcting defects in milk-plant equipment which were disclosed by a detailed sanitary engineering survey of all plants.

4. The cooperation of the U. S. Public Health Service was secured, with the result that its pasteurizing equipment testing station is located in Chicago.

That condition is rapidly being corrected all over the United States. That is another move that you men so ably helped us in. I am always appreciative of this group, because if you will remember the morning they threatened to send me to jail, you

men sent me off with a cheer and a fire—if you will remember the hearty support and endorsement you gave me—and I said that rather than to disappoint a group of men like that, I would go to jail.

5. The quality of the market milk supply as measured by bacterial counts was improved 45 per cent over the previous year.

When you consider that represents over one and one quarter million quarts of milk a day, and you can improve the quality of that market supply, over 45 per cent in one year, you can tell where the savings have been all along the line.

6. The improvement in Chicago's milk supply has evidently contributed toward a marked reduction in deaths of infants under one year of age.

If you will remember, they said that babies would die right and left if we dared to put on this program; there wouldn't be any milk.

The records show that there were actually 532 fewer baby deaths during the year ending March 28, 1927, than in the preceding years. This amounts to a decrease of 11.5 per cent. Not only did we have 500 fewer deaths in babies under one year than we ever had in our history before, but we led all the large cities in the United States for having a low baby death-rate under one year—the first time Chicago has ever done it, and milk contributed greatly toward that. (Applause)

Deaths from diarrhea and enteritis among children under two years of age were reduced 33.2 per cent during the same period, resulting in 274 fewer deaths from this cause.

That is all I have to say, friends. I don't know of a day that I would rather come here and give a public account of what I have done than this day, after what has happened. Here is my report. I appreciate the things that you have done to help us, and I hope at some future time I can be called upon to continue to do this good work. May God bless all of you. (Prolonged applause)

Mr. H. R. SMITH: I move we have this address published in pamphlet form for general distribution.

. . . The motion was seconded, put to a vote and carried unanimously. . . .

PRESIDENT VAN ES: I believe it is a misfortune that a man of this kind is removed from his activities. I am sure that, while he may not be a health officer, he will remain to the end of his days a health dynamo, because I do not know of any more dynamic individual than Dr. Bundesen. I think we will hear from him again, and I hope it will be on the floor of a convention of this organization.

. . . The meeting adjourned at 12:15 p. m.

THURSDAY AFTERNOON, DECEMBER 1, 1927

The fourth session was called to order at 1:45 p. m., by President Van Es.

PRESIDENT VAN ES: The first paper on the program is entitled "The Kansas City System of Milk and Dairy Inspection," by Mr. O. C. Murphy, of Kansas City.

MR. MURPHY: I have some forms here for those who might be interested in municipal milk control. They will probably be of interest and value to some of you. I have not enough to go around, but you are welcome to what there is. These are mentioned in my paper. There are some others here, having to do with the general milk situation, that have been worked out in our city and we think they are very good.

While it is still fresh in my mind, after hearing Dr. Bundesen this morning, I just want to comment on one or two things that he spoke of. One of them was in reference to the work that has been done in Chicago, with reference to correcting the faults of pasteurizing equipment. I just want to reiterate what Dr. Bundesen said, by adding that Kansas City has just taken the program as it has come from Chicago. We thought so well of it that we are attempting the same things they did here. They seem to be the pioneers in the investigation and, for that reason, it is past the experimental stage and we are thankful they have given to the public such results as they have.

. . . Mr. Murphy then read his paper. . . .

THE KANSAS CITY SYSTEM OF MILK AND DAIRY INSPECTION

By O. C. MURPHY, *Kansas City, Missouri.*

Commissioner, Division of Inspection and Sanitation,

In the short space of time allotted for the discussion of the Kansas City System of Milk and Diary Inspection, it is difficult to include many things that go to make up proper inspection service, consequently this paper is general in its scope.

It should be the purpose of every city health administration who has ideals, to arrive at the acme of success in developing a superior milk-supply in as short a time as is possible to do so. The success attained in Kansas City—and we believe it to be worth while—has taken considerable time and under difficulties which, I am sure, no other city has ever experienced.

Prior to 1912 there were practically no regulations and the supply was a pitiable one. In 1915 an attempted milk regulation was made. The ordinance enacted was difficult of enforcement due to lack of coordination between health officials, milk companies, producers and the people responsible for the ordinance. It was thought, in order to secure something worth while, that it would be necessary that disinterested experts be called in to survey the situation. I believe that practically everybody, who is close to the milk situation, knows something of this survey.

Conditions found during early inspections showed little understanding of sanitary milk production. Stables were few, small,

dirty, poorly lighted and ventilated; milk-houses were an exception rather than a rule. During the period between 1912 and 1920, the milk-shed extended some 125 to 140 miles, and the number of farms producing milk for pasteurization ranged from 2500 to 3500.

About 140 farms were selling raw milk to the consumer and there were doubtless many others of which the Health Department has no knowledge, due to inadequate inspection service. The present law was enacted in 1921 and is known as the "North Milk Ordinance." It was opposed bitterly by private organizations interested in milk and by many milk distributors, as being unfair and unjust, and that its enforcement would be impossible. Anyone who has read this ordinance can see that if 50 per cent is given, the city would have a fairly reputable milk-supply. The ordinance provides for the sale of raw and pasteurized milk, and the Kansas City situation is unique, in that approximately one-half of its supply is sold as raw milk. This in the opinion of health authorities is an unfortunate situation; however, it has been kept in very splendid condition to date. What the future holds for raw milk in our city depends entirely upon the prevalence of epidemics and failure of dairymen to observe regulations.

Someone has said that education is 99 per cent in results, and upon this theory the workings and operation of the Health Department, with reference to milk inspection, have had their growth. In order that all concerned would benefit from our program, it was necessary to seek the cooperation of the producer, distributor and consumer. In order that this combination would derive the greatest benefit from the program intended, it was necessary first to see that such a food product as milk should come from cows free from disease, and kept in good condition at all times, and at this time I wish to commend the veterinary profession.

The services of the trained veterinarian who is conscientious and who believes in the task before him, are absolutely indispensible and invaluable to the Nation's market milk industry. He is the "body guard" of our thousands of dairy cattle in their trials and endeavors to secrete a product which is safe and unquestionable for human consumption. When one considers the rapidity with which the milk industry has grown in the past few years—and very few people do—and to the billions of dollars in financial return, imagine what the result would be should the source of our milk be suddenly stopped. Then pause to realize the value of the services of the veterinarian, the daily service

that he renders in saving the lives of dairy cows and their progeny, and the bearing that this has upon human life. It is but to say that his is a real duty to perform, in giving protection to both man and animal. His services are indispensable. Many think of him as the common "horse doctor" and because of this his real usefulness is slow in becoming a realization.

I believe that health officials throughout the country should unite with such organizations as this one heretoday, to see that the so-called "horse doctor" is entirely eliminated, and that where services are needed that they be from a man trained in veterinary science. In my opinion the veterinarian is the middle man between the producer and the official charged with the enforcement of milk regulations, and for this reason he should be entirely in accord with all regulations pertaining to dairy cattle, and the production of clean, safe milk. He should be called in on all matters pertaining to the dairy cattle industry from which such city might obtain its milk supply.

The Kansas City Health Department believed in such procedure so strongly, that they asked that the local veterinary association appoint a committee, so that enforcement would be uniform, and that physical inspections would be standardized. This committee is one of our closest advisors, and the outline which I am distributing here is the result of the committee's investigation. I might add, with reference to committees, that we have committees representing all food lines, and all interested in health work, to confer with us in any endeavor in which they might be interested.

Before a veterinarian can do any work in the Kansas City milk territory, it is necessary for him to fill out an application blank. Such information contained therein shall have the approval of the committee as well as that of the Health Director. Veterinarians must be graduates of recognized schools. By a recent ruling which has just been made, he must limit his work to that of veterinary practice, rather than being in some other line of business and using his profession as a side-line. I believe that a two-fold service is brought about by this regulation. First, it places the veterinarian in the dignified position of which he is deserving. Second, the veterinarian, to do effective work, must be entirely cognizant of methods and keep abreast of all scientific investigations. This within itself is enough, rather than to have some other business in connection. We have found in our vicinity veterinarians who have had other business associa-

tions and when called upon to make dairy cattle examinations, that such examinations have not received the attention which the standard requires, and the charges made for same were not in accordance with services rendered, thereby creating distrust in the farmer for the veterinarian who might be attempting to carry out prescribed regulations, leading him to believe that cheaper examinations could be made with just as good results as the man who charged for thorough examinations. Veterinarians have been called before the Health Department for failure to observe certain regulations, and in some instances examinations have been rejected permanently, with the request that the veterinarian make no more examinations for the dairymen who supply milk from that territory.

There are forty-two veterinarians doing work in the Kansas City milk territory. Meetings are held from time to time with them, always keeping in touch with the work going on in their territory. The Health Department employs two veterinarians to check up such examinations when necessary, and to give advice on matters pertaining to technical investigations.

Our ordinance requires tuberculin tests of all dairy cattle producing milk or milk products, with the exception of butter, that are sold on the Kansas City market. At the time of our last check-up of farms it was found that there were 800 producing milk for ice cream, 1400 producing milk for pasteurizing and buttermilk purposes, and 186 producing raw milk. On these 1400 farms there are 22,045 cows tuberculin-tested annually; 16,045 of these cows are physically examined semi-annually, or a total of 32,090 examined annually. On farms producing raw milk direct to the consumer, there are 6,500 cows tuberculin-tested semi-annually, a total of 13,000 tuberculin tests yearly. Of these 6,500 cows, 6,105 are in milk and are physically examined monthly (these figures are taken from May 1, 1927), making a total from May 1 to December 31 of 48,840 physical examinations on cows from raw milk farms. It can be seen from these figures that considerable money is expended in seeing that cows are kept in good physical condition. This added expense has not been reflected in higher milk prices to the consumer. The regulation of physical examination was a most difficult procedure and considerable time elapsed before it began to function properly.

In the matter of tuberculin tests, in the early days the percentage of reactors ranged from 10 to 15 per cent; in 1921 it dropped to 4 per cent, and at the present time it is less than ½

of 1 per cent. However, a number of reactors are being found in herds that on previous tests were negative and particularly where no cattle have been added to the farm.

The enforcement of the milk ordinance is through the Division of Inspection and Sanitation of the Health Department. To enforce the provisions of the milk ordinance we have a personnel of eight employes, divided as follows: 1 chief diary inspector, 1 plant inspector, 2 raw milk farm inspectors, 2 sample collectors, 1 field inspector for milk for pasteurization, and 1 veterinarian who has an assistant in case his services are needed. This does not include the clerical department nor the laboratory, the latter maintaining five employes doing all work that might come up with reference to food control. In emergencies the entire sanitary inspection staff of the Department can be had. In addition to the Health Department personnel, we require dairy plants to provide field inspectors who are responsible to the Health Department for a great many of their actions with reference to their respective farms.

All milk coming into our city is graded and at present Grade "A" raw milk and Grade "A" pasteurized milk are the only ones available for whole consumption. However, other grades are provided for in the ordinance. In order that the consumer may get the product that the cap calls for, we allow but one grade of milk to be received into the milk-plant. This is necessary, because the matter of keeping grades separate would be entirely at the discretion of the plant management. This is not always done, hence the iron-clad rule that but one grade of milk be received into a plant.

The same regulations with reference to barns, milk-houses, tuberculin tests and physical examinations and equipment applies to buttermilk plants as well. We believe that by-products should receive as careful attention as is possible to give them, and are progressing rapidly with reference to ice cream, cheese and butter, that adequate protection may be afforded these commodities.

All farm, plant and distributor employes who handle milk as it goes to the consumer must be free from disease, as determined by competent medical supervision, such physicians being employed by the dairies. These examinations are made monthly. Since May 1, 8,800 medical examinations of milk handlers have been made.

All milk for pasteurization and buttermilk purposes is required to be delivered twice daily to the plants during the warm summer months, and in the case of the present year it was from April 1 to November 1. This regulation is not applicable to ice cream, but manufacturers have seen the value in such, and considerable milk for ice cream purposes has been delivered under the same system. Due to such delivery sour milk is scarcely known. We require milk from farms for pasteurization to be delivered within two hours, or as close to two hours as is possible, such tolerance being allowed during inclement weather.

All trucks used in transportation of milk are required to be covered, and in a case of delivery to the consumer such covering to be of a permanent nature. We require that every plant have adequate can-washing and bottle-washing equipment, sterilizers and can-dryers, and actually enforce the regulation with reference to dry cans, for in wet cans originates a great deal of our high bacteria count in milk.

To give you some idea of the number of inspections made since the first of May, the total field, milk and ice cream plant inspections approximate 9,000. This does not include field inspections by milk companies. Concentrated inspection is done where it is deemed necessary; where regulations are not complied with and the case warrants, the entire supply is excluded, either temporarily or permanently. All milk used raw must be bottled on the farm on which it is produced. No milk can be received into the city without having first been approved by the Health Department. Plans, equipment, and tuberculin-test, physical and medical examination charts must first be approved by the Health Department.

The laboratory department examined, for the milk section, 384 samples of water, 12,016 routine bacteriological samples, 7,000 butter-fat analyses, 175 samples of ice cream and 2,201 milk samples for special work with reference to pathogenic organisms and udder troubles. At present an extended program is being carried out which will be reported later and has to do with chemical sterilization and udder count.

Summary

For adequate milk control, field, plant and laboratory control must be given. This includes physical and medical examinations of both cattle and employes. Instead of 3,000 farms, we have 1,400 producing as much milk as formerly, the milk-shed extending 35 miles instead of 135 miles. Cows are being carefully

selected, due to physical examinations. A bacterial standard for the finished product of 30,000 bacteria per cubic centimeter has been maintained with a greater portion of the supply much lower, and 95 per cent of all pasteurized milk is coming out with better than 10,000 bacteria per cubic centimeter. We are reducing to a negligible factor complaints from various organizations that enforcement was impossible, such organizations now believing that still more stringent laws should be enacted, particularly on raw milk. Public confidence is being restored in a milk supply that for years was looked upon with disfavor.

The success of milk-inspection service lies in the ability of its personnel in being mindful of its responsibilities. The lives of millions of people are dependent upon the efficiency and rigidity with which the laws and regulations formulated for the purpose of safeguarding the milk supply of the Nation are enforced.

PRESIDENT VAN ES: The next number on the program is a paper entitled, "The Control and Eradication of Avian Tuberculosis by Education and Sanitary Measures," by Dr. Arthur J. Knilans.

. . . Dr. Knilans read his paper. . . .

THE CONTROL AND ERADICATION OF AVIAN TUBERCULOSIS BY EDUCATION AND SANITARY MEASURES

By ARTHUR J. KNILANS, *Janesville, Wis.*

Commissioner, National Live Stock Exchange

The first shipment of hogs from Hillsdale County, Michigan, on which the premium was paid, evidenced that if swine were to be free from tuberculosis, work, other than testing the cattle, should be done. The check-up made at that time indicated that the infection might be of avian origin, which fact was later corroborated by research work.

Very little attention had been paid to the question of avian tuberculosis by those engaged in the poultry industry. Dealers and packers had made no complaint, and the producers were indifferent as to the nature of their trouble.

Contact with the farm housewife in Wisconsin compels attention to the importance of the question from an economic angle, for ten cents of every farm dollar in Wisconsin is derived from sales of eggs and poultry. We find this to be a cash crop for the farm, which fact is lost to the men folks, but appreciated by the farm wife.

During the time I was a member of the Bureau of Animal Industry field force working on tuberculosis eradication, I contacted considerable tuberculosis in poultry flocks. My attention was focused on this condition particularly in localities where the farmer practiced housing of calves with the poultry, either for warmth or lack of room in the dairy barn.

My interest at the time was due to the possibility of infection to the bovine, as I found a number of these calves infected, the remainder of the herd being clean. This caused me to wonder if some practical plan could be evolved whereby the poultry flock could be maintained free from tuberculosis.

After research workers demonstrated the transmissibility of the avian to swine, it emphasized in my mind the necessity for some such plan.

On farms where I discovered avian tuberculosis and posted birds in the presence of the housewife, it did not take long to discover that the housewife was aware that something was wrong with the flock. I was simply able to point out the specific trouble to the interested party and make recommendations as to the elimination and prevention in the future. It happened that I was so situated that I could keep in touch with the flock-owners and was pleased to find that they acted on the suggestions, which resulted in the raising of a clean flock of birds.

Having a fair idea of the amount of infection in flocks and the number of flocks infected, and realizing the task of using tuberculin as a diagnostic agent, I thought that as long as our program of control was in a formative state, possibly a practical method could be worked out by surveying the poultry flock at the time the test was made on the cattle. This would at least eliminate the overhead attendant with a tuberculin test of the flocks.

Our organization being convinced by the work of Dr. L. Van Es that avian tuberculosis was an important factor in swine infection, I conferred with state and federal authorities in February, 1925. At this time an area tuberculin test was to be inaugurated in Green Lake County, and a survey of the poultry flocks was to be made in conjunction with the test of the cattle.

On the invitation of the state and federal authorities, I accompanied the men in the field and was surprised to find the amount of infection revealed in a careful check-up on the flocks. I further found that the flock-owners welcomed the survey, especially where much infection was found and where the losses were considerable.

We also found that many housewives, in the year or two previous to the survey, had recognized that some disease had gained a foothold in the flock, had dispersed the entire flock, cleaned and disinfected the premises, and, at the time of the survey, produced a clean flock for our observation. Flock history led us to believe they were dealing with avian tuberculosis.

On farms where infection was found by the veterinarian, a postmortem was held and time was taken to offer suggestions to the owner. This could not be done on farms where no infection was revealed to the inspector.

This led us to speculate on the possibility of cleaning up some if not the major part, of the infected flocks by means of an educational campaign, which would present to the owner of each flock information similar to that furnished the owners of infected flocks, presenting a sanitary program and stressing the need of following such a program, by using the information obtained by the survey. The interest was great at this time and the combined area test and flock survey was followed in Green Lake County with an intensive educational campaign.

This was arranged with the county agent, who advertised meetings by sending a letter to each housewife, inviting her to come, to bring any suspicious birds she might have, and her husband, if possible. Due possibly to the fact that the invitations were addressed to the lady of the house, the attendance was very good, and many birds were brought for postmortem. Not all the birds were infected with tuberculosis, for many of the common parasites were demonstrated. With a desire to have our recommendations taken seriously by the flock-owners, we avoided too elaborate a program of control. Therefore, we advocated a general policy for dealing with all conditions of an intestinal character, namely replacement with young stock on clean ground.

During the time of the area test and poultry survey there was considerable discussion among the field men as to how effective the program we were putting on would be in bringing about the desired results. This discussion and other events that occurred later caused me to keep in close touch with the project.

The work done at that time caused great desire for knowledge of poultry diseases, housing and management. Requests came to the county agent for more meetings and other phases of the poultry business came into the picture. Commercial houses buying poultry within the county reported a high percentage of

old stock marketed and often a high percentage of stock infected with disease, which was destroyed when brought to market.

A questionnaire sent out by the county agent, to the owners of flocks found infected, brought the information that the majority of the flocks had been changed and the premises cleaned and disinfected. Houses were rebuilt and a drive through the county would show you a great many new colony-houses with the young stock on clean range and old stock sent to market during the summer months.

While this was in progress, the Committee on Poultry Diseases was working on a plan which would be simple, logical, and appealing to the average farm-flock-owner. The plan presented at the banquet meeting held here last year is, in few words, as follows: Secure young stock by the incubator route. Raise in a portable brooder-house. When young stock is old enough to let out on the ground, move the brooder-house out on clean land that has not been used for range by the old birds. During the early summer, market all birds except the spring hatch if the flock is an ordinary farm flock. Clean and disinfect the premises as well as possible. In the fall, bring the young stock to the cleaned poultry-house and keep confined until the next spring. Then repeat the process, for at least three years.

This was what was done in Green Lake County and on farms where this has been practiced, the increased growth and better development of the young stock has been the oustanding result and this very likely means freedom from disease.

Since the adoption of the sanitary program a year ago, the writer has spent most of his time on this program. Many of our county agents have arranged meetings in which the question of maintaining a disease-free flock was stressed. The heads of the Poultry Department at the College have been most helpful in bringing this program to the front. Last spring we assembled, with the help of the Bureau of Animal Industry, an exhibit telling the story of the disease and its prevention. This was mounted on a trailer and was used at county fairs and at farm and village meetings. Unfortunately, the summer was too short to fill all the requests for meetings that came to the office.

The following is a quotation from the November issue of *Egg and Poultry Magazine:*

> Recently the President of the General Motors Research Corporation made the statement that it takes at least four years for the public to become saturated with an idea and that any campaign to instill it should continue for five years. In educational work to spread new knowledge

there is selecting of the most useful ideas and there is distributing them in form demanded by the average reader or hearer, but time is also needed for ideas to take root and grow.

In summing up, let me repeat that the farm wife is interested in her poultry flock and will follow helpful suggestions.

Meetings at which the question of poultry diseases is to be discussed are popular meetings and the attendance is good.

Postmortems are easily made and whether you find tuberculosis or parasitic infestation, you have ground for making recommendation of a new helpful sanitary program on the farm.

Experience has shown that the effort and cost of a clean-up are slight, considering the benefits derived.

In closing, I desire to quote Dr. L. Van Es, in a statement made before the Committee on Poultry Diseases last year: "The sanitary program proposed will prevent seventy-five per cent of poultry diseases; in fact, all the soil-borne diseases." My observations within the last year cause me to voice my whole-hearted, unqualified approval of his statement by subscribing to the program outlined above as an educational and sanitary program for eliminating tuberculosis from the farm flock.

PRESIDENT VAN ES: The next number on the program is a paper entitled, "Bovine Tuberculosis as a Public Health Problem," by Dr. D. C. Lochead, Deputy Health Officer of Rochester, Minn. (Applause)

. . . Dr. Lochead read his paper. . . .

BOVINE TUBERCULOSIS AS A PUBLIC HEALTH PROBLEM

By D. C. LOCHEAD

Deputy Health Officer, Rochester, Minnesota

Because of the fact that my Chief, Dr. C. H. Mayo, had other arrangements at the time, I was privileged in his stead to present a paper on "Bovine Tuberculosis in Humans," before the second annual Midwest Tuberculosis Conference, at Omaha, Nebraska, June 29, 1926. I did so with pleasure but with a certain amount of diffidence because it seemed to me I had little new to offer and my paper must be largely a compilation of already known facts. However, it was very well received and I was complimented by the Department of Agriculture of the State of Illinois having it printed. It might well have had the title of my paper today. I would suggest to those interested that you obtain a copy, because I intend at this time to avoid repeti-

tion as much as possible, in order to present some other thoughts and aspects of this important and stupendous problem.

On this occasion I am again impressed with the fact that I have little that is new to present and that I cannot speak with the voice of authority, especially in connection with the scientific aspects of the question. I would like you to accept my appearance here in the character of a salesman. You men have a wonderful service to sell humanity and I hope I can present some facts which will make your selling it easier.

But there is still the necessity to reiterate certain facts and to emphasize them, because there seems to be a considerable number of people who do not know or who refuse to learn; and the amount of organized opposition to our efforts to solve the problem indicates that definite propaganda to lower the bars against tuberculous milk cows continues to be carried on with unabated energy. If the antis are becoming less numerous, they have not lost anything in zeal.

Hardly a day passes without a letter coming to the Mayo Clinic from some and every part of the world, enquiring about the danger to humans of bovine tuberculosis and what can be done to avoid it. These letters are forwarded to Dr. C. H. Mayo, who is the City Health Officer, and who is, in addition, a farmer of considerable practical experience with bovine tuberculosis. Dr. Mayo refers these letters to me for actual answering.

Recently I have seen a statement, in a letter, that Dr. C. H. Mayo had offered $1000.00 to anyone who was able to show that there ever was a case of tuberculosis in humans that was traceable to bovine origin. That is an absolute and deliberate falsehood. Dr. Mayo can prove that for himself any day he chooses, from the many sick and crippled humans to be found in the Clinic. Dr. Mayo knows that tuberculosis in cows is a cause of tuberculosis in humans, not only theoretically but actually. Every scientist, expert and authority on tuberculosis knows it and it is only the rankest kind of a pseudo-scientist who will deny it. Proving it to unscientific minds is a hard job. Did you ever try to prove the world round to one of those square-world fellows? Tuberculosis is a mystifying disease, usually slow and insidious in its course. It is a systemic disease, especially by its toxins, and manifests itself usually by different local conditions, accompanied by tubercle formation. Its origin is buried in antiquity and it now has universal distribution. It is not likely to be eradicated in any sudden intensive effort by any one

method or by all. It would be foolish to shut our eyes to the many long years of earnest endeavor which will be necessary in the fight, using all methods available and continually searching for new knowledge and new methods.

Tuberculosis is a great big problem, whether in humans or animals. In fact it involves several big problems. No one knows all about it. In fact not one knows much about it, as is evidenced by the enormous number of qualified students who are spending their lives trying to determine the truth about it in several of its aspects. No good will result in our fight against it by deluding ourselves or trying to fool the public.

Bovine tuberculosis is an enormous economic agricultural problem that can be proven by figures and dollars, but it is also a real public health problem that cannot be so definitely proven by figures; and the loss of life and suffering from crippled children through its transmission to humans cannot be so well expressed in money values. To my mind, money spent on its prevention, while a drain on the public purse, is a proper expenditure, justifiable according to the value we place on human suffering, incapacity and life. That is always higher than actual commercial value, especially if the life belongs to someone near and dear to us and no one knows whom that will apply to tomorrow.

We cannot rest on the security of the small amount or prevalence of bovine tuberculosis in our herds today. As sure as the sun will rise, a low rate today will be a high rate tomorrow, because the disease unopposed by restrictive measures always increases in prevalence. It has been estimated by your distinguished and respected President, Dr. Van Es, that in a cattle population of more or less constant numbers the tuberculosis-rate doubles every fifteen years.

The solution of the whole tuberculosis problem by the use of what knowledge we have obtained by years of scientific research is mainly dependent today upon an enlightened public opinion; and, so far as bovine tuberculosis is concerned, upon the completeness of the information on the subject possessed by the owners of susceptible live stock. You as official and unofficial workers in the cause will win only in so far as you succeed in teaching farmers the reasonableness of your methods and the certainty of disaster from inaction. If you proceed as autocrats of officialdom you will fail. First sell yourself in the light of our present knowledge and then sell your methods to the farmers. Let us now proceed to consider what we have to sell and the

reasonableness of our position, especially from the public health standpoint.

How much or how often bovine tuberculosis occurs in humans varies some in estimation with different observers, at different times, in different places, states and countries, depending largely on the number of tuberculous cows in the milk supply and the amount of effort which has been put forth to prevent its spread to humans. Generally speaking, a conservative estimate is that 25 per cent of tuberculosis in children and 5 per cent of all tuberculosis is of the bovine type and occurs in all instances because it was transmitted from cows to humans.

The literature is full of estimates of different investigators, some of which are referred to in my paper on "Bovine Tuberculosis in Humans," including Fraser and Stiles, of Edinburgh; Rosenau, of Harvard; Stanley Griffith, of London; Chelsey, of Minnesota. Also Park and Krumweide, Wang and Collet, Jordan and Brown, Eastwood and Griffith. And many others are referred to by Dr. L. Van Es in his circular No. 23, printed by the University of Nebraska, dated February, 1924, entitled "Bovine Tuberculosis," which I commend to the earnest perusal of anybody interested in the subject as one of the best and most comprehensive publications obtainable.

Sometimes infection with the bovine type in humans causes pulmonary tuberculosis; but usually bovine infection results in tuberculosis in other parts of the body such as bones and joints, glands of the neck, abdomen and chest, intestines and meninges of the brain and spinal cord and generalized tuberculosis. The proportion of these non-pulmonary cases of tuberculosis due to the bovine type of organism has been referred to in my Omaha paper, as has also the fact that children suffer mostly from the non-pulmonary kinds of tuberculosis.

Bovine tuberculosis is undoubtedly responsible for a large percentage of non-pulmonary tuberculosis of childhood, which means that it is also responsible for a large percentage of tuberculous cripples, and it may so materially affect the health of the children that they will be seriously handicapped throughout life.

While bovine tuberculosis disfigures, cripples and handicaps humans, it is also responsible for many deaths from tuberculosis. How many, it is difficult to say. Different students and observers report different figures. Rosenau says about one-half of one per cent of deaths are due to tuberculosis. It has been estimated that 10 per cent of all deaths from tuberculosis in children under

five are due to the cattle germs. In New York City, Dr. Park estimated that 300 children died each year from bovine infection, and there is no reason to believe that New York is worse in this respect than other large cities of our country. It would be a conservative estimate to say that approximately 10 per cent of deaths from tuberculosis are of the non-pulmonary forms of the disease which, in a large proportion of the cases, have been proven to be of the bovine type.

It may seem unnecessary but I think it advisable to refer briefly to the ways in which bovine tuberculosis is spread to humans.

Occasionally butchers, veterinarians and pathologists become infected through wounds, but in most instances it is introduced into the alimentary canal through food or drink. Some cases occur from eating meat from tuberculous animals when the meat has not been sufficiently cooked, which sometimes happens; especially if the carcass has not been properly inspected and examined for tuberculous lesions, which often happens.

While the muscle tissues of tuberculous cattle are rarely diseased, it may happen that the bacilli are present in the meat, due to various factors. In acute miliary tuberculosis the blood contains the organisms and they may be on the muscle or in the meat juice. The lymph-nodes situated between the muscle layers may contain tubercle bacilli, even if normal in appearance. The meat may become contaminated during butchering from tools and by handling. From the standpoint of our present knowledge we must consider that practically every case of bovine tuberculosis in man is ingestion tuberculosis, contracted from milk or fresh milk products and gets into the tissues through the tonsils or intestinal tract. The tonsil, when infected, becomes a local focus and causes tuberculous glands of the neck, cervical adenitis, the old scrofula of years ago. From 2 to 5 per cent of tonsils removed in various cities show chronic tuberculosis, either of the bovine or human type.

From the alimentary tract the bacilli of tuberculosis are absorbed, at the same time as the food, through the intestinal wall into the lymph system, and thus are delivered into the blood. The glands in the abdomen connected with this absorption area are often infected, usually from the bovine type of bacillus. After a period of from one to several years, these glandular infections may clear up, although they not infrequently so reduce resistance that death results from tuberculosis or some

other disease, or they may cause several years of sickness and stunted growth with mental impairment. Once in the blood-stream, any tissue or part of the body is liable to infection, either primarily or secondarily, and we may have a rapidly fatal generalized tuberculosis.

It would not be out of place to consider how the tuberculosis germs get into the milk. Bovine tubercle bacilli occur in milk directly as a result of tuberculosis of the udder which, it has been stated, occurs in 1 to 3 out of every 1,000 cows. Chesley, of Minnesota, reports: "In 1200 autopsies of reactors, udder tuberculosis was found in 5.75 per cent. In generalized tuberculosis the udder has been found to be affected in about 17 per cent. Frequently cases of generalized tuberculosis show no clinical symptoms of udder involvement." During milking, the udder is essentially an eliminating structure and even though it is not involved locally, tubercle bacilli may pass out in the milk, just as tubercle bacilli are passed from healthy kidneys when the tuberculosis is elsewhere in the body. If the udder is tuberculous, of course many more bacilli will be found in the milk. Milk from a tuberculous udder may contain as many tubercle bacilli as there are ordinarily found in sputum from tuberculous lungs. The milk from one tuberculous udder may contain sufficient bacilli to infect seriously the milk of 25 to 30 cows. At the initial stage of udder infection, very often the disease is difficult to diagnose. The changes may be of microscopic size yet sufficient to allow organisms to pass through. But tubercle bacilli may occur in milk indirectly, through cow manure. With lung tuberculosis tubercle bacilli are coughed up, swallowed and passed in the manure. The manure gets into the milk in many ways with which we are all familiar, carrying its tuberculosis germs with it. Furthermore, it is not necessary for the cow to have lung tuberculosis in order that the tubercle bacilli may be present in the manure.

Keller and Moravek read a paper before the Medical Association of Greater New York (published in the November 20, 1915, issue of the *Medical Record*) in which they report experiments of inoculating guinea pigs with suspensions of tubercle bacilli into joints and subcutaneously, and by the eighth day, recovering acid-fast bacilli from their feces with no presence of intestinal lesions and on injecting cultures from the feces into guinea pigs the pigs developed tuberculosis. They concluded that no matter how the bacillus is introduced into the system, it will make its

appearance in the feces without producing a pathological lesion in the intestinal mucous membrane.

So that if there is tuberculosis present in any part of the cow, it may be excreted in the milk or be present in the manure.

The possibility of the presence of tubercle bacilli in milk is not only theoretical, it is of practical importance. It does occur. How often or how much varies in estimationwith different investigators in different cities, states and countries. The literature contains many reports.

Miller and Mitchell, working under Fraser and Stiles, when they were studying bovine tuberculosis in humans, investigated the food supplies of patients. They found by extensive and difficult laboratory tests, including the inoculation of guinea pigs with the sediment and cream after centrifuging, that from 16 to 20 per cent of the Edinburgh milk supply was infected with tubercle bacilli; and by other complicated tests, including the inoculation of rabbits, determined that the germs were bovine tubercle bacilli, which convinced them that the milk supply was a great medium for conveying bovine tuberculosis to humans. Similar investigations have been conducted in this country with varying results as to the frequency and amount of bovine tuberculosis germs found in milk—from 6.7 to 29.5 per cent.

In four typical American cities, of 551 samples, tubercle bacilli were found in 46 (8.3 per cent). This may be taken as the average percentage for the entire country. These figures are likely an underestimate, for the methods used in the laboratory are not sufficiently delicate to detect a few bacteria in milk. Unless present in numbers, they are apt to escape detection. Recently Tonney, White and Danforth collected statistics of 16,700 milk samples, of which 8.6 per cent showed contamination with tubercle bacilli. The figures varied from 61 per cent in Berlin, in 1894, to 3.5 per cent in Chicago, in 1923-25.

It has been proven that bovine tuberculosis is frequently transmitted to humans, usually occurring in children and usually in other forms than lung tuberculosis.

But possibly the situation is much worse than that. Behring, Krause and Rosenau draw attention to the fact that most of all our tuberculous cases received their infection during childhood, the infection remaining latent until adolescence or early adult life, and many tuberculosis authorities agree with them.

We know that infection with bovine tuberculosis occurs usually in infancy and childhood, so why may not the majority

of tuberculosis cases in adults be the result of bovine infection in childhood, especially when such an authority as Adami favors the opinion that the bacilli may, on account of long residence in the human body, take on the characteristics of the human type of tubercle bacillus? If that is the case, then may not lung tuberculosis which is the commonest form in adult life, even although apparently showing human tubercle bacilli, be due in many cases to bovine infection during childhood? I say apparently showing human tubercle bacilli.

Humans and animals such as cows, hogs and poultry suffer from tuberculosis. The disease is similar in all but there are differences—differences of receptivity, susceptibility and anatomy. One naturally asks, "Where lies the difference?" Is it in the germ? Is it in the animal? I think the real difference is in the animal, although there are apparent differences in the germs.

While several investigators had earlier observed a relationship between human and bovine tuberculosis, it was not until the end of the eighteenth century that the idea started to gain ground. In the early part of the nineteenth century a number of prominent investigators contended that pulmonary tuberculosis of cattle and man were identical. Further, several other workers expressed the conviction that pearl disease of the peritoneum in cattle and tuberculous peritonitis in man were analogous.

In 1865 Villemin demonstrated that tuberculosis could be transmitted from man to animal and from animal to animal by the inoculation of emulsified tubercles. This definitely proved the infectiousness of the malady and also established the relationship between the disease in man and the lower animals. In 1882 Robert Koch demonstrated the organism in cases of tuberculosis, cultivated it in pure culture, reproduced the disease with such pure culture and again recovered the organism. In 1898 Theobald Smith established certain morphologic, cultural and pathologic differences between the human and bovine species of the germ.

The bovine bacillus is often shorter, plumper, and stains more uniformly than the human bacillus, which is ordinarily club-shaped, irregular, and stains with interrupted markings. These characters are not sufficiently distinctive to distinguish one type from the other. In culturing, the initial isolations are very difficult, especially with the bovine variety. Glycerin-egg

medium is not satisfactory for the growing of the bovine bacillus, while it tends to stimulate the development of the human bacillus.

The human bacillus grows luxuriantly upon culture media, covering the entire surface of the medium with a rich, dry, crinkled, mold-like vegetation. The growth of the bovine bacillus upon artificial culture media is more sparse, thinner, less extensive, and somewhat slower. The human bacillus produces in artificial culture media a different reaction curve from that produced by the bovine bacillus.

The essential difference lies in the fact that the human type is very pathogenic for man and guinea pigs, but has little pathogenicity for cattle, rabbits and other animals. On the other hand, the bovine type is very pathogenic for almost all mammalian animals except man; it is pathogenic for man, but less so than the human bacillus. Even when large numbers of the human bacilli are injected into a calf, a general disease does not usually result; at most, only a local lesion is produced. The critical test used in almost all laboratories is upon rabbits. When .001 milligram of a bovine culture is injected intravenously, or 10 milligrams subcutaneously, into a full-grown rabbit, generalized tuberculosis results in about six weeks; whereas 10 to 100 times these amounts of a human strain produce at most a slight localized tuberculosis.

Instead of a problem of the interrelation of human and bovine we now have a problem of the interrelation of all types and forms and also the effects on the tubercle bacillus of favorable or unfavorable elements encountered in its passage from one generation to another in hosts of the same and in hosts of various animal species. Also the effects on the animal hosts themselves, especially with regard to increased resistance on the one hand and greater susceptibility on the other, are but little understood.

Maybe the real difference is in the animal and that long residence for thousands of generations in different animals has given the respective germs slightly different characteristics and when transplanted into a different animal after generations of residence they may take on the characteristics of that animal type of germ. The fact that there is usually or often difficulty in transplanting a germ to another type of animal does not entirely dispute this theory. Everybody knows the difficulty man, animals and plants encounter when transplanted to an entirely different environment, especially of temperature and nourishment. But persistence wins. So may not the possibility of disease trans-

mission by different types increase with repeated doses of infection?

Dr. C. H. Mayo has said:

> The slight difference in type or form between the bacillus of tuberculosis of man and that of animals has led to much dispute. By gradually varying culture medium, much higher or lower degrees of virulence may be produced in most germs. Direct attempts to inoculate apparently fail, yet it is known that cattle rapidly infect each other; healthy hogs in the same yard with infected cattle become infected as do the poultry, a sufficient number of bacilli in varying forms existing in barnyard manure.

So if cows and hogs and chickens and humans catch each other's tuberculosis more or less easily, why is the germ concerned not really the same germ?

Again Dr. Mayo says:

> While various observers have found slight difference in size and shape of bacilli in the human, bovine and avian forms of tuberculosis and difference in time of staining, they are so slight that they represent far less variation than those found in streptococci by Rosenow, who was able to show transmutability among *Streptococcus viridans*, *Streptococcus hemolyticus* and the pneumococcus under varying degrees of oxygen tension of the culture medium.

Rosenow, in his studies of lesions produced by the streptococcus, shows that it is possible to convert a hemolytic streptococcus that has a marked affinity for joints into a *Streptococcus viridans*, which later will have lost its affinity for the joints, and acquired a marked affinity for the heart-valves, producing hemorrhages in the heart-valves and endocarditis, often without arthritis. He also succeeded in transforming this germ into one that has the property of attacking the flat muscles and tendinous portions of the long muscles. He was able also to isolate the same germs in rheumatic cases, from the blood in four cases out of seven, in two cases from the stools, and in one from the tonsils, and when these strains were injected into animals, they proudced the exact picture of transient non-suppurative arthritis, the exudate showing few or no organisms, and subendothelial nodular endocarditis, also pericarditis in some.

"Considering all the evidence, we must believe that the bacilli of these three types are but variations of one species of organism and not different entities," concludes Dr. Mayo.

All of which may mean that bovine tuberculosis in humans is a much more serious proposition than is expressed in the statement that bovine tuberculosis is a frequent cause of tuberculosis in humans, especially in other forms than the pulmonary and especially among children. Bovine tuberculosis may yet be demonstrated to be the cause of much of our pulmonary tuber-

culosis and much of the tuberculosis of all forms which demonstrates itself among adults.

Therefore, we humans are much concerned with the presence of tuberculosis in other animals, especially cattle, from the public health standpoint. Those of us who are trying to solve the problem of bovine tuberculosis in humans are naturally concerned with your problem—bovine tuberculosis in cows.

When discussing the question of bovine tuberculosis as a public health problem, I would consider my paper unfinished if I did not say something about preventing it from occurring in humans. I recognize that here I am entering the controversial field, although I cannot see why there should be controversy.

There are several ways of proceeding. There is no one way free from objections. There is no one way that will immediately eradicate bovine tuberculosis or prevent it spreading to humans. We must not supinely sit with folded hands helpless. We must not wait for evolution or slowly developing species immunity. We must use any and all methods as much as possible.

We can prevent the transmission to humans by the use of sufficient heat in cooking meat and by pasteurizing milk. I discussed proper pasteurization of milk in my Omaha paper. I am a pasteurized-milk enthusiast, but no one would be quicker than I to agree that there is much room for improvement in the pasteurizing process, as it is too often carried on, and we all appreciate that there should be much closer official supervision of pasteurizing plants than is commonly practiced.

When proper pasteurization is carried out, definite results are obtained. Official figures from New York show a decrease in annual death-rate from non-pulmonary tuberculosis per 100,000 from 29 in 1910 to 12 in 1925. Tuberculous glands of the neck in years previous to pasteurization showed more than 50 per cent due to the bovine type, whereas only six of fifty specimens when pasteurization became general were bovine. Five of the six were from out-of town patients fed on raw milk—showing the effects of raw milk where pasteurization is not practiced and never can be economically practicable and where sole reliance must be placed on the tuberculin test.

Pasteurization is a great factor of safety—but only a factor. The milk must be good milk to protect us in the event of accidents in operation or to the pasteurizing machinery because pasteurization is, after all, merely a mechanical device, not a moral obligation. Also, pasteurization is hard to accomplish with a small

local milk market and we must remember that over 50 per cent of the population of the United States live in rural districts, farms or communities under 2500; and there too occur 60 per cent of the births.

We must also bear in mind that milk for butter, cheese and other milk products, which frequently contain tubercle bacilli, is not pasteurized to the same extent as milk for drinking.

We can take steps to see that tuberculous animals are not a source of infection by being used in the meat and milk supply.

Milk should not be used from a tuberculous cow, whether it is to be pasteurized or not. No sensible person would engage a tuberculous nurse-maid. No sensible person would willingly permit his children to play with other children who are known to be ill with such a communicable disease as tuberculosis.

Every diseased animal removed makes for a better and healthier herd and a more desirable milk supply.

For more than forty years, experiments have been carried on in the hope of finding a satisfactory method of immunizing against tuberculosis by the use of (1) living virulent tubercle bacilli, (2) dead organisms, (3) living avirulent organisms. In the first method the potential danger is too great, the second has never been successful and the third has never been very successful.

Recently Calmette, in France, discovered a method which, to say the least, inspires us to hope that he has been successful but we have felt the same way about several other procedures in the past. Calmette, in 1908, isolated from bovine origin a tubercle bacillus which he passed through 230 successive subcultures on a special bile-glycerin medium—his BCG. Virulence has apparently been reduced by a lowered surface tension. He claims good results in protecting infants and reports are favorable. If he is correct, we might be able gradually to build up tuberculosis-free herds. Years will be required before its efficiency can be proven or disproved. Some authorities claim that analysis of the evidence and the lack or insufficiency of control experiments lead them to doubt seriously the conclusions arrived at, especially as these for the most part are based upon the apparent freedom from tuberculosis of young vaccinated cattle, of which a large majority are males that had reached the abattoir under three years of age. The real test must come after the vaccinated animals, particularly cows, have been for several years under the strain of reproduction and heavy milking and have withstood the test of time. Other authorities advise caution and desire

information as to what happens to the tubercle bacilli injected during the vaccination and wonder whether it is possible for the organisms to recover their former or original virulence. Such studies should be supported and encouraged but hopes for success should not stand in the way of continuing our present methods of control.

A scientific theorist recently gave utterance to the thought that possibly milk from tuberculous cows tended to immunize children against human tuberculosis and we must expect some pseudo-scientist to urge us to cease our efforts to prevent tubercle bacilli occurring in milk. If it were true, which is unlikely, because no scientist has yet succeeded in immunizing against tuberculosis by the use of living tubercle bacilli, the method is haphazard, irregular and unscientific. The dose of tubercle bacilli may be too large, too numerous, too frequent or untimely for safety, in view of the fact that bovine tuberculosis in humans may be severe and even fatal. If proven true, then the dose should be accurately measured as to amount, time and virulence.

Obviously we should try to eradicate tuberculosis from the cows, and that is some job; and here again we are on controversial ground. There are those who maintain that the clinical method is best. That is the elimination of obviously open cases of tuberculosis, both of the lungs and udder. I need only say now that in my opinion the system does not exist which will enable us to eliminate all or a sufficient proportion of tuberculous cows by this method.

The best method of eradicating tuberculosis from a herd is by the tuberculin test. Of course it is not 100 per cent efficient. One test will not spot every tuberculous cow and as long as there is a cow present in a herd that has been in contact with a cow that was tuberculous, there is a possibility of that cow reacting on the next test and there is a possibility of that cow spreading infection. Eradication of tuberculosis from a herd is not a simple or easy matter, but that does not dispute the fact that tuberculin-testing is the best method of eradicating tuberculosis from a herd; or excuse us for neglecting to use the procedure.

The tuberculin test is an efficient specific treatment with tuberculin which in practically all cases will indicate those animals which are infected with the tubercle bacillus.

Tuberculin is obtained by growing the tuberculosis germs in bouillon, then killing them by heat so they cannot cause infection, and filtering to remove the dead germs. Koch discovered that

when this material is put into a tuberculous animal body there will be a distinct reaction. We have not yet discovered how or just why the reaction takes place. It certainly is an active response of the body cells to the stimulus of the injected agent very similar to the reaction (hives) some people have after eating certain foods.

The test material may be placed under the skin, into the skin or into the eye. Under the skin the body temperature rises; into the skin, a particular swelling of the skin occurs; into the eye, a definite congestion results, in each instance only if the animal is infected with tuberculosis. The intradermic method was adopted by your Association in 1920 as the method of choice but sometimes two or all three methods are advisable.

The successful use of the intradermic method calls for great skill and much experience on the part of the veterinarian, such as is required to be an accredited veterinarian by the state and federal authorities, because it is really a delicate operation, necessitating the placing of the tuberculin in the proper place under usually difficult conditions; and the proper reading of the reaction calls for good judgment, definite skill and much experience in order to differentiate between a definite reactor and a suspicious case.

Sometimes the question is asked, "Is there any harm from the test to the animals tested?" Some people have the idea that it may poison them or even give them tuberculosis. It is a proven fact that normal animals may be given large doses of tuberculin without any ill effects of any kind, but when tuberculous animals are injected with large doses bad effects may result.

With tuberculin intelligently and properly applied by a person skilled in its use and with a working knowledge of the disease in cattle, a means becomes available by which tuberculosis can be recognized with a high degree of certainty long before any physical evidence of the disease can manifest itself. The tuberculin test indicates that tuberculous infection is present; it does not indicate how much or how badly and it affords accurate diagnosis in 98 per cent of the tests. It misses some. Nothing in the world is 100 per cent perfect and no test used in medicine is perfect. The tuberculin test is nearer perfect than the Wasserman test for syphilis, the Widal test for typhoid, the throat swab for diphtheria, or the sputum test for tuberculosis.

There are always factors of error. The test may not be done efficiently or under ideal conditions, or the tuberculin may be a

little off. Sometimes repeated tests or larger doses are necessary. The reaction is theoretically strongest when the body cells are busy combatting the tuberculin stimulus, that is, when the cells are fighting an active tuberculosis. The tuberculosis may not have reached that stage when the test is made or the infection may have passed the stage where the cells respond to the stimulus; they have lost their sensitiveness to tuberculin; but these animals usually present physical signs by which the disease can be recognized. An occasional animal infected with tuberculosis may not react to the test for the following reasons:

The disease is not far enough advanced or it is a very far advanced case or maybe it has become temporarily arrested. Sometimes cases of generalized, miliary or meningeal tuberculosis do not react. Also an animal that has recently had tuberculin will not react for a number of weeks. Consequently if there is a question of that, the test should not be made for sixty days. This applies especially to new animals coming into a herd. They should be isolated for sixty days, as this is a common way of reinfecting a herd that has been cleaned up.

If the tuberculin test leads to errors in the diagnosis of tuberculosis, they do not usually occur in the animals reacting positively. In fact it has never been satisfactorily proven that a reactor was not tuberculous. Tuberculosis infection is always present in a reactor, even if there have been no signs or symptoms of it and the reaction is accepted by practically all authorities as conclusive evidence of tuberculosis even if there are no lesions, especially typical tubercles found on the after-death examination of the animal. For lesions may be present and be missed, even on a very thorough examination of the carcass.

In a small proportion of cases, tuberculosis infection may be present in an animal without producing the typical tubercles or any lesion which is like the tubercle. In fact tuberculosis may be present in the body without producing any recognizable lesion even by the use of the microscope. The body cells may not sufficiently respond to the attack of the infection to produce the typical changes, which we believe means resistance to the infection on the part of the body. Tuberculosis may be present as a blood or lymph disease without as yet having produced any lesions. If you are interested in this question of no-lesion reactors or in the atypical and unfamiliar lesions, I would recommend for your perusal a paper read by Dr. Rudolph Matas, before the Alabama Medical Association and printed in

the *Southern Medical Journal*, September and October, 1911. It is one of the most comprehensive studies I know.

Is it possible so to improve the tuberculin test that it will be 100 per cent perfect? Not so far as we know, as in all biological work of this character; but by improvements in the quality of the test material, personnel and technic, results may be made so satisfactory that the method will be more easily justified. There is need for research on the nature of tuberculin and a study of the tuberculin and immunological reactions and especially in determining the state of activity of tuberculous lesions and to correlate these reactions with the transmissibility of infection. For some time there has been a demand for the purification and standardization of tuberculin from the different types of bacilli and a considerable advance is being made in the study of tuberculin, its purification and perfection and in the isolation of its active principle.

More and more research is needed, not only on the tuberculin question but upon the whole problem of tuberculous infection, sensitization and resistance. Some portion of appropriations for eradication might profitably be expended upon research.

I would urge also that all animals not obtained from tuberculosis-free herds be required to pass a tuberculin test before purchase and that they be segregated from the herd they have passed a re-test, which should be made two to three months after their arrival at the farm, a double dose of tuberculin being used.

Once we have discovered the tuberculous animal, whether by clinical examination or the tuberculin test, or by both, it should be removed from the herd and the test and examination should be repeated at least once a year on the herd in order to keep it as near 100 per cent clean of tuberculosis as is possible.

Having discovered the tuberculous animals and removed them from the herd, what disposition should be made of them? With humans we attempt to cure them by the use of all available agencies generally useful and individually indicated. We teach them how to order their lives and habits to the end that they will favor their cure and avoid spreading their disease to others. Often the sanatorium is advisable and necessary as a place of treatment, training and isolation.

If tuberculosis in cattle is ever cured, it is not by any known methods of treatment and not by nature sufficiently often that dependence can be placed upon it. The cost would be enormous, especially in view of the short profitable productivity life of

animals, and especially in view of the cost of isolating them and without such procedure there would be great probability that the disease would be transmitted to others and that the process of saving one animal would necessitate its repetition for a dozen others. Under ordinary conditions prevailing in cattle-raising, the disease will pursue its natural course and slowly but surely reduce the animal to a state of non-profitable productivity and subsequent loss of value altogether.

Is isolation of reactors a method of procedure? Theoretically this method is possible with cattle as with humans. It has been tried many times, most notably by Bang, in Denmark, where apparently success can be reported. It has not been found practically possible. The only excuse for its existence is the use of the cows for breeding purposes. In this country the average calf is so cheap that the great expense, care and attention necessary to isolate and keep reactors for breeding purposes would not be justified.

Separate barns and equipment should be furnished, special care must be taken in cleaning and disinfecting utensils, and calves have to be handled separately and expensively. Then there is the danger to the humans handling the cows, and to those using the milk or milk products after a more or less successful pasteurization, which, even if it does destroy the tubercle bacilli, may possibly leave undesirable and disease-producing toxins. Then there is the enormous expense of official supervision and control of these many isolation places, without which the method will always fail.

Also the percentage of reactors in this country is not high enough to justify the expensive procedure for so few cattle. Certainly it is not a commercial possibility for the average individual cattle-owner or for small areas, especially with anything but high-priced animals. In Europe the average value of cattle is much higher than here and the percentage of reactors is considerably higher. So they cannot afford to remove them definitely from the milk supply. They have to put up in Europe with many tuberculous cases and high death-rates, scarred necks, crippled limbs and distorted backs, which with us are being materially reduced and becoming uncommon. Milk and milk products from reacting cows have poor market possibilities in this country, even after pasteurization and rightly so.

Bang himself, in appearing before the American Veterinary Medical Association this year and discussing his method, said:

> The carrying out of the measures requested demands great vigilance and perseverance on the part of the farmers as well as of their servants, qualities not always met with. I admire the efforts you have made since 1917 by accredited herd plan and the area plan and I am sure you will reach your goal in this way if the states will continue to cover the great expenses to indemnify farmers.

Concerning slaughter of all reactors he said:

> A great number will never be affected so that the milk is apt to contain tubercle bacilli. Of course I admit that nobody can tell with certainty if a reacting cow belongs to this category or if the tuberculosis is inclined to grow and reach a contagious form and it therefore may be safest to slaughter it.

Dr. Van Es has said in his valuable publication mentioned before:

> In herds which the writer had occasion to supervise, the method was always successful but proved to be quite irksome to the owners. For this reason the method has never enjoyed popularity in this country and has only found application in herds of exceptional breeding value. Owing to differences in the management of herds, labor conditions and the prevailing morbidity rate, it appears that the Bang method is more suitable to European conditions than to those generally prevailing in this country.

Our knowledge of tuberculosis is not complete by any means, but it has progressed and accumulated to such an extent that for many years the majority of those who know have advocated a concerted, sane and practical possibility of eradication of bovine tuberculosis—the area plan. This plan provides for the slaughter of reactors and the tanking of carcasses so involved as to be unfit for food. It is effective and fool-proof. Bovine tuberculosis is a public health problem and the animals having it must be removed from the milk supply.

It is not a problem for the individual cattle-owner or even the single community. It is a problem for a considerable area, even a state or commonwealth. The county modified accredited area plan so popular in this country is producing wonderful results and rapidly reducing the bovine tuberculosis menace so that we may reasonably feel that there has dawned the day of eradication of bovine tuberculosis.

More than 1,250,000 tuberculous cattle have been slaughtered since the campaign was launched without causing the always threatened shortage of milk, and the dairy industry, more than any other type of agricultural endeavor, in prospering today, because statistics show that the consumption of milk has increased nearly 50 quarts per capita in this country in the last ten years.

Of course the area plan is not perfect and could be improved. Even I can suggest improvements. Boards of county commissioners should be empowered to embark on area testing by majority vote and compelled to act on presentation of a majority

petition of taxpayers. When the majority of counties have adopted area testing, then it should automatically become operative all over the state. It should always apply to all cattle, regardless of sex or any other consideration, within the testing area and only milk from tested animals should be allowed sale in the testing area or in the state when the majority of counties have accepted area testing. Steers or feeders should be tested. In Minnesota steers sometimes run as high as 6 per cent reactors. We can cite many specific cases where strictly range cattle have been found to be infected.

I commend for your approval the resolution of the American Veterinary Medical Association at its recent meeting: Concerning regulatory measures in connection with the county area plan of tuberculosis eradication in order to protect expenditures made to render more effective the actual accomplishment of tuberculosis eradication under the county area plan.

A resolution designed for the protection of modified accredited counties and to prevent them from becoming reinfected with tuberculosis by further restricting the movement of cattle from non-accredited counties into modified accredited counties or counties in process of accreditation whether for dairy, breeding, feeding or grazing purposes.

I would caution you against leading cattle-owners and the general public to think that the success of the area plan means more to them than the facts warrant. Remember that eradication can be only relative. Absolute removal of all infected cattle and of all the tubercle bacilli which may infect them should not be expected; for as long as there are sources of infection on earth there is danger of infection. We who pin our faith to the area plan must expect to adhere to a policy of eternal and unceasing vigilance.

I feel that I cannot close my paper in any better way than by quoting from a paper prepared for your twenty-eighth annual meeting by my respected Chief, Dr. C. H. Mayo. He said:

> With the appreciation that many of the diseases of animals may become a source of danger to the people about them, or to those who use their products, will come an appreciation of the need for more veterinarians, and for better inspection of the dairy herds in our country. This should call for a veterinarian in every city as general food and dairy inspector, who will test cows for tuberculosis, so that milk will not carry disease to innocent children.
>
> The work of the United States Live Stock Sanitary Association in the prevention of tuberculosis in animals and man is being welcomed by the American people who fear the disease and are ready to follow the plan prepared by the society for its abatement.

PRESIDENT VAN ES: It is always refreshing to be permitted to see our own problems through the eyes of those who stand a little bit further removed from it than we ourselves. Dr. Lochead has accomplished this in a very splendid contribution.

DR. C. A. CARY: I think that this paper should be published for public distribution, just the same as Dr. Bundesen's, because of its value to the public. Therefore, I make a motion that this paper be published for public distribution.

. . . The motion was seconded. . . .

PRESIDENT VAN ES: It has been moved and seconded that Dr. Lochead's paper be published by this Association in pamphlet form for general distribution. Are there any remarks?

. . . The question was called for, put to a vote and carried. . . .

PRESIDENT VAN ES: The next paper on the program is entitled, "Tuberculosis Eradication Work in the Central States," by Dr. J. A. Barger.

. . . Dr. Barger then delivered his address. . . .

TUBERCULOSIS ERADICATION WORK IN THE CENTRAL STATES

By J. A. BARGER

Inspector-in-Charge, U. S. Bureau of Animal Industry
Des Moines, Iowa

The officials of the central states were very kind to supply me with information about their local conditions. They were so kind, they furnished me so much information that when I had it compiled it took one hour and one-quarter to read. I tried to condense it a little bit, and I believe under that condition you will pardon me for just making a few remarks, because what I had in the paper and what I have intended to say has been largely said already, and I don't believe it would augment it or make it more valuable to have me say it again. For instance, I give myself credit for having the same thoughts as my predecessors on this platform, in paying respects to the veterinarians and in saying something of the necessity of education.

I gathered from the statements that I got from the various men in charge of the work of the several central states, that the laws are somewhat different under which they work. Some of the states have only state appropriations, while others have state and county appropriations. But the work of testing the cattle, and the general work of tuberculosis eradication, of course, is essentially the same.

The great outstanding thing that I gathered from these papers and from conversation with the men in charge of the work in those states is this: There is a public urge for the

tuberculin-testing of cattle. This is signified by the very large state appropriations and county appropriations, the effort that is being made to come within the provisions of the accredited herd testing and the extension of the area testing

I may say, too, it seems to be generally true of all of the central states, that no big promotional campaign has been pursued. They feel this way about it: This is the work of the people, and when called upon, they have furnished speakers, and at all times they have answered correspondence and furnished explanations, and when the work was finally adopted, placed men in charge of it to see that it had splendid supervision, the thought being that the work should be done so well and with such great care that it would recommend itself to the people of the adjoining counties.

It is going to mean a whole lot to the central states to be able to market their hogs without the retentions on account of tuberculosis, and to raise cattle from sires and dams that are free of tuberculosis. In the central states there are something over 16,000,000 cattle, and while the hogs do not have any bearing upon the tuberculosis eradication proposition, yet there are 25,000,000 of these animals on the farms in the central states. You can see that so far as numbers are concerned, the problem of eradication of tuberculosis in the central states is quite a large one. But this we find true, that the people are already realizing some reward for their efforts. For instance, the ten-cent premium per hundredweight for hogs marketed from the counties that have eradicated tuberculosis has meant more to the farmers of those areas than the entire cost of eradicating tuberculosis.

To my mind, the proposition of eradicating tuberculosis is less complex every year. The people are coming to realize more fully their responsibility in it. Surely no one would continue to raise diseased live stock and expect to get a good price for it.

There must be something in being a party to a deal where the buyer and the seller both share in the profits. Today there is no attractive market for untested cattle. That is evident all over the State.

In the central states, and I presume that applies to all of the states of the Union, any breeder of cattle, or any dairyman, regardless of how small or large are his holdings, can come within the provisions of the law to receive indemnity, and with that in view there seems to be no reason why any man should

stigmatize his own reputation by trafficking in tuberculous cattle, or to sell them to his neighbor, even though he might have an opportunity to do so. There are no attractive markets for them, and it is bad business. People are trying to get away from those things.

With regard to avian tuberculosis eradication, you have heard much of that today, and I don't know that I could add much to it. I will say, though, that in all of the inspections that are going on in these states, the veterinarians are required to inspect the chickens of the farms, so in that way, in the course of time, every farm in all of the counties in which we are engaged in tuberculosis eradication will receive an inspection. That means very, very much, not only as a means of freeing the hogs of tuberculosis, but we must realize, too, the enormous output of eggs and chickens, and how much this means to the country in the aggregate.

We always realized that the final conclusion of the work was predicated on the ability to do a good job. We pin our faith entirely upon that. We feel that if we are able to clean up all of the herds of the county, the people will see what we are doing and realize that it is a thing that may be applied to them. Congress and counties have never hesitated to make appropriations, but they have said this: "We want to see a good job done, and we want to see it done economically."

I think the field forces have met every reasonable expectation in that respect. I have reached that conclusion, and so have the other men of the central states, I am sure. We base it upon the fact that so many of the herds that show infection on the first test do not show infection on later tests, and in some whole counties, as many as 75 per cent of the herds clean up on the first test.

Another thing is quite significant, and that is, while the no-lesion reactor has never been a bad problem in the central states, yet it is gratifying to know that in looking over post-mortems of over 42,000 animals, a very small percentage failed to show lesions as a result of the first test, and those that I speak of right now are first-test animals. This information has not been requested by the Bureau, and I don't feel that I should let it out here, because it covers, as yet, too small a number of animals.

There is another thing that is very pleasing to us, and that is in many of the counties the test per head has cost only twenty-

three cents. It is true that over the entire central states it has cost thirty-three cents per head, but that covers the accredited herd testing, and not entirely the testing under the county area plan, and that is the testing I refer to as having cost twenty-three cents.

I cannot pay too high respect and commendation to the practicing veterinarians who have cooperated with us in the eradication of tuberculosis over the central states. Their acquaintance with the stock-owners and their touch have added something to the work, that cannot be dispensed with. On the other hand, let us hope that the benefits have been quite mutual, because in the area testing the veterinarian's acquaintance has been extended, and as many of them will tell you now, who live in modified areas, this work has brought them into pleasant contact and friendship with people they did not know before.

We realize that while no one will reap a financial harvest as a result of testing cattle for tuberculosis, yet it is one of the most essential pieces of sanitary control eradication work we can think of. I can't imagine any veterinarian or other person who has an opportunity of doing so, failing to realize his responsibility in it.

We say we are well on our way with the eradication work, but it seems to me the hardest part is yet to be done. I don't know that we have anything to regret for the water than has gone under the bridge, but it would be a mistake if we would spend too much time in dwelling upon the accomplishments and fail to realize the things we might leave undone or might do carelessly, which might reflect discredit in the end. I have in mind these: I can see that the careless injection of tuberculin; the failure to clean and disinfect premises properly; the failure to explain properly to owners why it is necessary that their cattle be classified as reactors and slaughtered as reactors; the failure to keep informed the agricultural and daily press of the accomplishments in tuberculosis eradication. All of these things are highly important and we must not neglect any of them. But, as I see it, if we keep on and have our ear to the ground all the time and continue to seek information and guidance from the cattlemen and other people, the success that we have hoped for will be ours in the end.

PRESIDENT VAN ES: Next we will hear from Professor H. R. Smith. (Applause)

. . . Professor Smith gave his address. . . .

TATTOOING HOGS AS AN AID IN MORE COMPLETE ERADICATION OF TUBERCULOSIS

By H. R. SMITH, *Chicago, Ill.*

Commissioner, National Live Stock Exchange

It is getting rather late and I will try to make my remarks as brief as possible, sticking to the subject as closely as I can. I think most of you men here realize what is being done in the central states, particularly in the matter of stimulating interest through the payment of the ten-cent premium. I may say in this connection that the ten-cent premium is now amounting to nearly $60,000 a month. It is confined very largely to the central states, the hog-producing states.

Unfortunately, we are not finding the killing tests on these hogs enough better to justify fully the ten-cent premium. If these hogs should all come practically free from tuberculosis, it would be fully justified, because it is known that the average loss in hogs, caused by tuberculosis, is approximately ten cents a hundred. It stands to reason that this is an overhead charge to the industry, and every packer who handles hogs that are diseased, where a certain number are condemned or retained for tuberculosis, the loss on hogs goes in like an overhead charge, the same as buying coal or anything else.

It stands to reason that in the reduction of the overhead charge, whatever it is, if it can be reduced, it means a little higher price to the producer, possibly a little lower price to the consumer, because there is bound to be a spread between the cost of processing, influenced by the various factors.

It is a fact that in any market that draws on a territory, rather badly infected with tuberculosis in hogs, the price of hogs automatically adjusts itself to that situat on. In those markets where we do have a high loss, there is a depression caused by this disease. So it is a logical thing to stimulate interest and to recognize the work of the men in these counties by giving them a little higher price for the hogs, if they can come practically free from tuberculosis. I say they are not coming free, and in some counties that are accredited they are far from being free. We find a great difference in counties. The nearest place where they are actually proving to be worth nearly ten cents a hundred, as far as I can determine, is at the Rath Packing Company, of

Waterloo. Mr. Rath gave me figures recently, showing that the loss on accredited hogs killed at that plant during the past six months was three cents a hundred, whereas the loss on the non-accredited hogs killed at that plant during the same period was 11½ cents a hundred, making a difference of about eight cents. I think it is safe to say that at the present time, in all of these accredited counties, the saving is probably about five cents a hundred, whereas they are paying out ten cents.

Fortunately, we have men in the packing business who are broad enough and are so intensely interested in the success of this campaign, that they are carrying on in the hope that the hog will come cleaner eventually, and will be more nearly worth the extra ten cents. I wish more of them were doing that. We have quite a large number of small packers who are not paying the premium. We have a great many in the East who are not paying the premium. All the large packers are paying it; all of the Iowa packers are, and a great many others are. It is mounting to a large sum of money.

In the two largest packing concerns of this country, the premium checks this year will total in the neighborhood of $300,000 each. That means quite an investment. It is true that while these accredited hogs are not returning full ten cents per hundred more, we do have a very decided improvement in the killing of the cattle, and they are all interested in that, of course. When we recognize that through this great campaign, the retentions in cattle have declined from an average of 2.6 per cent, ten years ago, to 1.1 per cent last year, that shows progress, certainly, in reducing the losses on cattle. Were it not for the avian element, we might expect the same general progress in reducing the retentions in swine.

I think you are interested in knowing the retentions in swine did not begin to decline until something like four years ago. They kept increasing steadily, in the face of a decline in cattle retentions. It was something like this: starting with 2 per cent in 1908, going up to 15.2 per cent in 1922, but now dropped down to about 13 per cent. There is now a gradual decline in swine retentions on all hogs killed in the United States.

The results that we have from these killing tests are on accredited hogs, and I might say to you that we have asked the packers to kill separately just as many of these loads of accredited hogs as they can, and they have done so very willingly. We have killing tests on several million accredited hogs, and in a general

way I might say that the killing tests on these accredited hogs show a decline of approximately 75 per cent in condemnations, and approximately 25 per cent in retentions, about one-fourth less retained in all of these accredited counties, compared with the general run. In some markets we find more, and in some markets we find less. It has been interesting to note that in the accredited counties where we have the highest percentage of retentions, our state and federal officials have also found a high percentage of the flocks of poultry reacting to the test. It has been of great interest to note that in these demonstration tests that have been carried on, in the central states particularly, it is not unusual to find 75 per cent of the poultry flocks infected with tuberculosis. A physical examination would reveal not over one-fourth of the flocks infected. It has brought out conclusively the physical examination is very incomplete, that the test is required to give us our accurate status of flock disease.

The hogs that are killed in these accredited counties are showing up remarkably well, so far as condemnations are concerned. We do not find more than a very few condemned. In some counties it is down to less than 0.1 of one per cent condemned or sterilized. On the other hand, we find some counties where the retentions are up as high as 30 per cent, in accredited counties, and we have reason to believe that poultry infection in those counties is very high, and it has been proven so by the tests that have been made.

So far as the tattooing is concerned, I might say this: It is planned to require that hogs from accredited counties must be tattooed for identification, first of all, to obviate the necessity of killing them separately. They are getting so numerous we cannot begin to kill them separately. We have not the facilities for them at the yards, and yet we want the data to know how they are going to kill out. That is very important. By the tattoo system we will be able to throw them all together, all the accredited hogs in one big drove, and have them killed at a certain time during the day. By having checkers, as they come over the rail, put down the tattoo marks, in that way we can identify them on the killing-floor and be able to trace them back to the farm.

I think you are familiar with the tattoo-marker, the one invented by Dr. F. E. Murray. He has certainly served the public in a very great way by this device for tattooing hogs. It has been improved to a certain extent, and it is doing very good

work. We have done a great deal of tattooing at the various packing-plants, and the mark is clear, and it remains in the skin for a long period of time. As you know, it is printed in by striking the hog on the back of the neck, and by a system of letters and numbers, it is easily possible to trace the hogs back to the individual farm from which they came.

The system we have in mind is using the first letter for the state, the second letter for the county, the third letter for the shipping station, and the fourth digit is a number. We use numbers to represent the names of the individual farmers at the shipping stations. So it will require not over five digits, and these digits will appear on the back of the neck, because it does less damage in that part of the carcass.

As you know, the material used is a mixture of lampblack, a form of carbon, and oil; ordinarily, lubricating oil is all right, or linseed oil mixed in about equal parts. It makes very clear marks, indicated by black points, and gives the outlines of the letters and numbers in the skin. Of course the tattoo-marker will be available as soon as possible. We can not put it into operation until we get enough markers, so they can be distributed and used at the shipping stations.

In a recent demonstration in Iowa, where a large number of county agents were present, the county agents were asked to tattoo the hog. It was slaughtered in the college laboratory, and all the marks showed very clearly. I was interested at that time in hearing several county agents say they are having more or less trouble in certain sections of the country from hog-stealing. We know there is a great deal of chicken-stealing. It has all been brought about by the good roads, and the use of trucks. They were interested in this as a possible means of lessening the stealing of hogs. I do not know that it is done to a great extent, but it is to some extent. It occurs to me the tattoo mark has possibilities, because it can be used when the pigs are quite young, and the tattoo mark remains in the skin for a long period of time; five or six months is nothing unusual. Some of the hogs that were killed at Hillsdale, Michigan, had been tattooed the year previous. The tattoo mark will be useful for the purpose of identifying the hogs of any particular farmer.

I am not sure, but if this works out properly, there may be a system established where the township will be the unit rather than the shipping station, and it may be possible in time to give each farmer a particular number, and have it registered, so we

will know at any time from where the hogs came. We are interested in this not only because it will obviate the necessity of separate killing tests, but the thing I am particularly interested in is that it will make it possible for us to get the cooperation of more of the eastern packers in the payment of the premium. The eastern packers having order-buyers on the large central markets are not paying the premium directly. They are paying it indirectly, and in this way: Any commission salesman who has a consignment of accredited hogs tries to get every cent he can out of the hogs. He recognizes that the local packers are paying the ten-cent premium, and if he bid is $10, it means $10.10 after he presents his certificate. He, therefore, will not sell the hogs to an order-buyer unless the bid is higher than $10.10. So the order-buyer does pay the premium, but indirectly, because he competes with those who are paying it.

The commission salesmen tell me, when they are trading with an order-buyer, or some one who does not pay the premium directly, they make it a selling point by telling them in advance the hogs are from an accredited territory, and invariably the order-buyer will bid a little higher because the risk is less on the hogs. The order-buyers have indicated that one reason why they do not like to pay the premium directly as a premium is because they have no means of checking up on their results. If they pay the extra ten cents, they want to know how they are going to kill out.

I have reason to believe if we had a tattoo system so they could be identified anywhere—Iowa hogs killed in Pittsburgh—the Pittsburgh packer, through the key, can determine exactly from which farm they came. I have reason to believe that under the tattoo system we will get the cooperation of many more eastern packers in making it as a premium. That is what we want. It is the direct premium that furnishes the stimulus. Every official in the Corn Belt or hog-producing industry recognizes the value of the ten-cent premium as a stimulus. It seems to me we should get more of them in under the plan of paying it directly and not indirectly as a premium. The tattoo-marker used on the farm or at the shipping station will be a positive method of identification.

The thing that appeals to me in the way of possibilities in the use of this is, first of all, a check on your work. We know it is impossible to test counties and make the work thorough, make it 100 per cent. You are bound to overlook some reactors, and the

hog will determine, through this means, which farms might have been overlooked, where there might be still a little infection. The tattoo-marker also will reveal those farms where, though the cattle may be free, the poultry is infected. Every worker who has had anything to do with avian tuberculosis recognizes the fact that the test is impractical on poultry. It is valuable only as a demonstration to determine the conditions as they are found in the country. It is impractical to think of using the test as a means of eliminating avian tuberculosis. The tattooing of hogs will be a means of locating those farms that have avian tuberculosis. In view of the fact that we cannot depend on the test because of the high cost, we believe this will be a very valuable means of tracing back to the farms that show disease in poultry.

I would say the tattooing of hogs is simply an aid to the thorough clean-up of tuberculosis. We believe it has great possibilities in that way. Some people are a little skeptical about the value of tattooing. They wonder what the attitude of the farmers will be. "Will they think it is too much trouble? Will it be too much expense?" The expense of a tattoo-marker complete, with the letters and numbers, at this time is about $10. That is less than the premium on one load of hogs. That is out of the question. They can not say it is an expensive proposition. "Will the farmers refuse to tattoo?" They certainly would refuse if they did not have a premium. The only way we can expect to have them tattoo the hog is to withhold the premium if they do not tattoo. That certainly is a reasonable proposition. If a premium is paid on the hogs, it seems to me any packer has a perfect right to ask that some little mark be put on the hog by which he can be identified. It is a reasonable proposition, and this requirement, I want you to understand, is not as a penalty. It is not done as a penalty; it is done simply as an aid to the more thorough clean-up of tuberculosis in these counties.

We want this premium plan put on a sound basis. It is not on a sound basis now when ten cents per hundred is paid and only five cents per hundred is returned. We all recognize the value of that as a stimulant, and we want it continued, and we what it on a sound basis, so it can be continued. I wish to say to you there is reason to believe it will be continued, if it is put on a sound basis. That is what we want.

I feel that the people who are asked to tattoo the hogs will not object to it. We have not found it so. With the permission of your Chairman, I just want to have a word from one of our

commissioners who has done a great deal of tattooing, who knows what the attitude of the people is toward it. I would like to have him give a word on the attitude of the people toward tattooing.

PRESIDENT VAN ES: "Results of Some Avian Tuberculosis Studies at the North Dakota Experiment Station," by Dr. A. F. Schalk.

. . . Dr. Schalk read his paper. . . .

RESULTS OF SOME AVIAN TUBERCULOSIS STUDIES*

By A. F. SCHALK, *Fargo, N. Dak.*

Department of Veterinary Science, North Dakota Agricultural College

Almost all workers associated with tuberculosis investigations are beginning to recognize a problem complex that appears to be developing in connection with the various types of *Mycobacterium tuberculosis* organisms in their relationships with the more comprehensive tuberculosis problem.

That extensively wide-spread avian tuberculosis infection exists in the common barnyard fowl and turkeys in many sections of the country is self-evident and many of the sanitary and regulatory officials of those territories are making the inquiry as to what extent this disease is complicating the nation-wide tuberculosis eradication work now in active progress.

On the average farm where diversified agriculture is carried on, practically all forms of animal life, common to farm premises, have almost ideal conditions and opportunities for exposure to and actual cohabitation with the farm poultry which may be harboring the disease.

Fully realizing that these conditions prevail, in no small measure, in our own territory, the Department of Veterinary Science of the North Dakota Experiment Station in 1922 outlined a series of experimental projects involving many phases of the subject that may have an important bearing upon the problem. We have been particularly concerned about the transmissibility of avian tuberculosis to the various classes of animals on the farm, endeavoring to determine if they actually become infected or are simple mechanical carriers of the disease and further to determine the longevity of the organisms outside of the living infected fowl.

*The information submitted in this paper is from experimental data collected from some special studies on tuberculosis by H. L. Foust, L. M. Roderick and the writer, of the Department of Veterinary Science, North Dakota Experiment Station.

In the course of these studies, our constant aim has been to repeat and check all experiments sufficiently so that a considerable amount of data could be accumulated from which conclusions may be deducted. While some of these studies may be considered completed, others require further investigations.

Transmissibility of Avian Tuberculosis to Other Species of Animals

Early in our studies it was learned that swine, particularly young pigs from six to ten weeks of age, are quite susceptible to avian tuberculosis. Pigs placed in cots with infected birds overhead on lattice-bottom floors, whereby the pigs can ingest the fresh contaminated droppings, became infected in approximately 80 per cent of the cases.

Likewise a similar percentage of pigs contract the disease when given one or two feeds of finely ground avian tuberculosis organs or when they devour infected carcasses. Eight young nursing pigs, which had access via a creep to a poultry-yard harboring infected birds, all contracted the disease within forty-five days of such exposure. From these and other carefully controlled experiments one is almost led to believe that young pigs are as susceptible as the natural host, the common fowl, when transmission is carried out via the ingestion method.

Typing Localized Swine Tuberculosis Lesions

In order to determine to what extent avian tuberculosis existed in swine in our own locality, thirty specimens of localized tuberculous lesions were selected at random from individual animals emanating from North Dakota and western Minnesota and typed by small-animal and common-fowl inoculations. By this method 88½ per cent resulted in avian infection and the remainder were either bovine, mixed or negative. It is significant to know that the avian infection was precisely the same as that obtained by Van Es and Martin, of Nebraska, who have apparently covered this phase of the problem quite thoroughly.

Lesions of Avian Tuberculosis in Swine

Avian tuberculosis, in all our experimental cases, has proven to be a consistent localized disease. This applies regardless of the method employed in transmission. While a very large majority of cases were contracted by the ingestion methods, a couple of animals that were given extremely large dosages of tuberculosis inoculum via the subcutaneous, intraperitoneal and

intracardial routes also manifested the disease only in localized areas. The lesions were usually slight, few in number and confined to the retropharyngeal and mesenteric groups of lymph-nodes. Occasionally the liver presented a few pin-head areas atypical of tuberculosis lesions which, when viewed under the microscope in stained preparations, were lacking in acid-fast organisms. Not a single case of generalized tuberculosis has been encountered in this work.

An Experimental Tuberculosis Cage Barnyard

With the idea of approaching the transmission problem in the most logical and natural manner, an experimental tuberculosis cage barnyard was constructed in the spring of 1924. This yard was designed and made to simulate ordinary barnyard conditions as nearly as possible. It is 108 feet long, 38 feet wide and 8 feet high and completely closed in with fine-mesh woven wire that holds within and keeps without all animals and birds as small as English sparrows. A small open-type shed is located at one end for shelter and beyond this there is no shade. It is situated on comparatively level gumbo soil, colloidal in nature, which is quite characteristic of the entire Red River Valley. There is no special drainage.

During the last four years, from about June 1 to Nov. 1, this yard has served for natural exposure purposes. It is stocked with an average of 72 positive-reacting tuberculous chickens, which cohabit continuously for four and one-half to five months with seven to nine young cattle, seventy-five to one hundred pigeons and what English sparrows can be procured, which average about fifty per year. One year a yearling colt was harbored therein and another season a litter of eight nursing pigs had access to the yard for about forty-five days. Each year from one to two dozen young chickens from four to ten weeks of age were reared in the barnyard.

All cattle and the colt were previously tested with both mammalian and avian tuberculin and found negative to same before they entered into the yard. As there is no available test for pigeons and sparrows, about the only way of arriving at their status in regards to tuberculosis is to slaughter and autopsy a number of birds obtained from each source. Accordingly from one-fourth to one-third of all the birds secured were killed and postmortem examination held. It may be stated at this time that we have not found a single sparrow spontaneously infected

with avian tuberculosis, and the infection in pigeons examined averages less than 3 per cent for the four-year period.

Results of Exposure Experiments

The cattle exposure experiments make an inquiry into many undetermined conditions.

First, to determine if cattle by natural exposure become infected by avian tuberculosis as evidenced by manifest lesions.

Secondly, in the absence of visible lesions is there a definite sensitization to avian tuberculin established?

Thirdly, if definite sensitization to avian tuberculin by avian tuberculosis organisms has been established, in the absence of lesions, will such sensitized animals react positively to mammalian tuberculins? This latter condition, if present, may possibly have considerable bearing on the so-called no-lesion case.

The question arises in the minds of field men operating in territories where cattle are continually exposed to large numbers of infected birds, is it not possible that such cattle, by ingesting large numbers of the avian organisms from the contaminated droppings, may react positively to mammalian tuberculin?

The data accumulated to date show that approximately 75 per cent of the cattle in the experimental barnyard become sensitized by the avian germs and react positively to avian tuberculin. They show also that the animals sensitized in this manner are invariably negative to mammalian tuberculin tests. On only a couple of occasions, of the many tests made, were even suspicious reactions observed, which invariably terminated entirely negatively upon subsequent 30-day retests.

Sensitization but Temporary

Finding practically no evidence of visible tuberculosis in the animals slaughtered at the close of our first year's work, it was thought advisable during the last two years to hold the reacting animals over for subsequent tests and later autopsy. This procedure brought out the significant fact that all the reacting cattle lost their sensitization within two to five months after having been removed from the exposure barnyard. Last year five of the yearling reacting cattle in which the sensitization had completely faded out were retained and placed in the tuberculosis barnyard for the second time, with the result that three of them became resensitized as two-year-olds. Again they were kept and again the sensitization was lost within a few months.

These three animals as three-year-olds were inmates in the exposure yard for the third time during the past summer and two of them became sensitized for the third time.

Degree and Extent of Infection—Lesions

Evidence gathered from autopsies made upon the avian-reacting cattle slaughtered would certainly lead one to conclude that avian tuberculosis in cattle is not an economic problem. Particular precautions were taken to carry out the most detailed postmortem examinations possible in a number of the animals. In addition to a painstaking examination of all organs and tissues covered in ordinary inspection, very careful examination was made of all lymphoid tissue, such as the tonsils, Peyer's patches, and crypts of the alimentary tract, for possible lesions or lodgments of accumulations of the avian tuberculosis organisms.

Subjected to such rigid inspections, only a couple of the animals presented visible lesions of the disease. The lesions were few in number ranging from pin-point to pin-head size or slightly larger and confined entirely to localized tuberculosis in the retropharyngeal and mesenteric lymph-nodes. The lesions appeared to be of an arrested nature, with no inclination whatever towards generalization.

Aside from the cattle that were carried through the barnyard trials, fifteen other young cattle were exposed to tuberculous fowls in open yards or placed in box-stalls where they had access to droppings from the infected birds. The results were precisely the same as with the barnyard-exposed animals.

The Pigeons and Sparrows

During the four-year period approximately 300 pigeons and 200 sparrows have cohabited with the tuberculous fowls. At the close of each fall all the pigeons and sparrows were slaughtered and autopsies held. In neither group have we been able to increase the percentage of infection over what prevailed in the check birds that were autopsied before the remaining birds were placed in the barnyard. These results would strongly indicate that neither pigeons nor sparrows readily become infected with avian tuberculosis from comparatively heavy exposure to the disease, such as prevailed in the barnyard. Thus it would appear that these two classes of farmyard birds are not potent spreaders of the disease as infected birds.

Fate of Avian Tubercle Bacilli in Contaminated Barnyard During Winter Months

About November 1 each year, at the close of the summer and fall experiments, all animals and birds are removed, the gate locked, and the yard left to the natural elements of the winter weather. From April 1 to 15 of each succeeding spring, about two dozen healthy non-reacting chickens and from seven to ten six- to ten-weeks-old pigs, that have proven negative to both avian and mammalian tuberculins, are placed in the barnyard for periods ranging from forty-five to sixty days. They are then removed to clean, uncontaminated quarters, where tests can be made from time to time. During the three years that this experiment has been in progress, avian infection has manifested itself in 17 to 35 per cent of the healthy chickens and 33 to 70 per cent of the pigs, as evidenced by avian tuberculin tests and autopsy. Evidently the rigorous climatic conditions of our northern country do not appreciably affect the virulence of the avian tuberculosis organisms.

Transmissibility of Avian Tuberculosis to Common Rats, Barn Mice and Field Mice

Numerous attempts have been made to infect common rats, barn mice and field mice with avian tuberculosis via the ingestion method. Large numbers of these rodent animals have been fed repeatedly over long periods of time, for several months to a year or longer, with large quantities of active tuberculosis lesions from infected fowl. At times pure cultures of the avian germs were added to these rations in abundance. The tuberculosis virus was supplied in such a manner that the litter of the cages in which they were harbored was continuously highly contaminated with the disease germs. In addition to these experiments scores of common rats have been kept in constant cohabitation with great numbers of heavily infected birds in box-stalls for more than a year, and several cages of rats have been given intracardial and subcutaneous inoculations of heavy dosages of avian tuberculosis. In all of these experiments the results have been absolutely negative, as not a single case of visible infection has been encountered.

We regret that we have not had the opportunity to try to infect barn mice and field mice by subcutaneous and intraperitoneal and possibly other inoculation methods. It would appear from these data that these classes of animals do not con-

tract visible infection with avian tuberculosis under ordinary conditions and thereby do not enter into the carrier problem as infected animals.

How About Pigeons, Sparrows and Rats as Mechanical Carriers of Avian Tuberculosis?

The modes of dissemination and distribution, the carrier problem, the intermediate host or hosts are factors of supreme importance in almost all infectious diseases, the solution of which are usually beset with many obstacles and difficulties.

Although we found it impossible to increase the percentage of avian infection in pigeons and sparrows from marked natural exposure in our tuberculosis barnyard and were entirely unable to produce infection in rats under any conditions of feeding or inoculation, there still remained the possibility of these animals being simple mechanical carriers of the disease from animal to animal and from farm to farm.

To that end box-stalls were used inside and specially designed yards were constructed outside in an endeavor to determine that question. In the box-stalls a small opening was made below in the concrete partition for the rats and a window above for the passage of the pigeons. Outside two cage-yards were built for the sparrow and pigeon experiments. At either end of each yard a small enclosure was arranged for twelve tuberculous and twelve healthy chickens. A passage-way about 40 feet long, covered with small-mesh poultry wire, connected the two enclosures, occupied by the healthy and diseased birds, respectively. In one of these yards a number of pigeons were confined and in the other sparrows. The pigeons and sparrows cohabited with the tuberculous and healthy chickens for about four months during the summer and fall. The experiment was carried out for two years. While tuberculosis was contracted by each of the four groups of healthy birds, some irregularities developed the first year which would tend to question the absolute reliability of the results.

With reference to the inside studies, both rats and pigeons never failed to carry the disease from the tuberculous birds in the one stall to the healthy chickens in the other. Recently the inside experiment was repeated, using healthy four-months-old pigs instead of chickens, common rats being the medium of possible mechanical carriers. After thirty days, two of the pigs reacted positively to avian tuberculin, to be followed by the

remaining two at the 60-day test. Subsequent autopsy confirmed the disease in the four pigs.

Rats Carry Avian Tuberculosis Organisms through the Alimentary Tract in Viable Condition

Having proven to our satisfaction that common rats are mechanical carriers of avian tuberculosis, it was deemed advisable to determine if this is accomplished by the germs clinging to the external covering, hair-coat, feet and dragging tail or through the alimentary canal from eating tuberculous material.

A half-dozen adult common rats were fed upon finely ground tuberculous fowl organs and carefully dipped in antiseptic solution to remove and destroy any germs that may be clinging to the exterior of the body. The rat feces were then collected and mixed thoroughly with grain mash and fed to four healthy non-reacting chickens. This was done three times in the course of about one week. At another time the rats were fed and dipped and placed in a lattice-bottom cage directly over four non-reacting chickens, where the birds had free access to the rat droppings. In each experiment three out of four of the healthy chickens became reactors and contracted avian tuberculosis.

Sensitization of Cattle with Avian Tuberculosis

The experimental tuberculosis cage barnyard experiments have demonstrated rather conclusively that cattle become sensitized to avian tuberculosis quite readily from natural exposure to infected barnyard fowl under ordinary barnyard conditions. The question arose in our minds as to how easily and with what minimal quantities of the avian virus this senstitization could be established.

Two methods of sensitization have been employed, viz., via instillation of the virus into the conjunctival sac and by rubbing it into the scarified skin. Recent isolated avian cultures were grown for about two weeks upon solid media, the growth removed, accurately weighed, carefully diluted and measured to definite dosages, which ranged from 1.0 to 0.0001 milligram for these trials. Insofar as can be determined the conjunctival sac and the scarified skin serve equally well for the application of the avian virus.

When dosages of 1 mg. to 0.01 mg. of the virus were used by either method, approximately 80 per cent of the animals became sensitized, as evidenced by avian tuberculin tests. Quantities of

0.001 mg. sensitized about 50 per cent of the animals and the small dose of 0.0001 mg. led to more than 20 per cent sensitizations. During the last summer two herds of cattle, numbering 100 head, and ranging from week-old calves to 12-year-old cows, revealed about 20 per cent of sensitization to avian tuberculosis when given 0.0001 mg. of the avian cultures in the conjunctival sac. Again it was significant to note that there were no cross-reactions, i. e., the avian-sensitized cattle did not react positively to mammalian (bovine) tuberculin, while they gave positive reactions with the avian product.

These data, though somewhat limited, would indicate that cattle are highly susceptible to avian tuberculosis sensitization with no inclination to develop visible lesions of the disease and that such sensitization obtains from extremely small dosages of the avian virus. It is highly probable that cattle with breaks or abrasions in the skin can become sensitized to the avian disease when lying down, if the abraded portion of the skin should happen to come in contact with the droppings of a tuberculous fowl whose feces contain the avian germs in large numbers. Further, it is possible for cattle to become sensitized, should dust arising from the dried contaminated droppings become lodged in the conjunctival sac of these animals. Thus the minimal dosage for sensitization has not as yet been determined.

The Incidence of Avian Tuberculosis Reactors in Feeder Cattle

Realizing from the foregoing experiments that cattle can be sensitized to the avian type of the disease upon slight provocation, the question arose as to what extent avian sensitization prevails in the ordinary run of stockyard cattle.

By courtesy of the Armour Packing Company, of West Fargo, N. Dak., we were given the opportunity to test the left-over feeder cattle that accumulated from time to time from June 1 to November 1 of the present year. The intradermic test method was applied and both avian and bovine tuberculin tests were made simultaneously, using one tail fold for avian inoculation and the other for the bovine. Only one reading could be obtained, which was invariably at the 72nd hour. In all 507 animals were tested in this manner, with the result that 79 animals (15.5 per cent) reacted positively to the avian test, while only two cattle responded to the bovine product. The bovine reactors were separate from the avian reactors; there were

no double or cross-reactions. These figures are lower than we anticipated. For the last three years, practically all cattle purchased for experimental purposes for our department have been subjected to the avian tuberculin test and approximately 25 per cent of these animals have shown to be positive avian reactors.

The fact that most of these cattle were tested during the winter and late spring, when cohabitation or exposure to the farm poultry flocks was most probable, possibly explains the higher number of reactors than that encountered in the animals which were tested during the summer and fall, when the cattle were at pasture with but little or no contact with the barnyard fowl. If the latter conditions prevail, undoubtedly some of the summer- and fall-tested animals had already lost their sensitization, as has been demonstrated in our experimental-barnyard cattle.

Possible Eradication of Avian Tuberculosis from Farm Poultry Flocks by Testing

A consistent plan of flock-testing was projected and carried out as follows. Two areas of somewhat different geologic conditions were selected, one in the Red River Valley, where the soil was heavy gumbo and colloidal in nature, and the other where the soil was light and composed mainly of sand and loam. Systematic annual testing was resorted to on most of the farms, while on others semi-annual testing was practiced. In all nearly 17,000 birds were tested, in which fifty-eight flocks were subjected to four annual tests and sixteen flocks were tested semi-annually. Immediately after each test all reactors were removed from the farm and a thorough clean-up and disinfection was carried out under our supervision. A summary of the results is herewith recorded.

	No. of Birds	*No. of Flocks*	*No. of Reactors*	*Percentage of Reactors*
	Annual Test			
First	5381	58	1640	30.4
Second	2609	23	698	26.7
Third	2200	23	501	20.3
Fourth	784	4	100	12.7
	Semi-Annual Test			
First	1023	16	227	22.1
Second	1936	16	197	10.1
Third	1175	16	58	4.9
Fourth	1720	16	153	8.9

The data revealed in this project would indicate that while this method will materially reduce flock infection it will not completely eradicate the disease.

Failure to eradicate the disease in this manner may be accounted for in different ways. First, the failure of the test to detect all the infected birds. These remain as infection carriers and probable spreaders of the disease, through their widespread droppings, that are often richly impregnated with the avian organisms. Secondly, our incomplete knowledge of and inability to locate all the unknown foreign-host carriers and possibly other occult depots or reservoirs of the infection and, lastly, the probable extended longevity of the avian organism in the soils, litter and manure, and infected dead carcasses scattered carelessly about the premises.

From existing conditions and our knowledge of the efficiency of the tuberculin test in cattle we cannot hope to eradicate avian tuberculosis from fowls by testing only. If the tuberculin test in fowls is equally as dependable and efficient as the bovine test, the undetected infected birds in a flock will be manifold that in cattle, as the average farm poultry flock contains from five to ten times as many birds as cattle. Thus, there are a proportionately greater number of missed cases of infection which may be spreaders. Further, from the very nature of the disease in these two classes of live stock, undoubtedly fowl are more consistent and potent spreaders than cattle.

As to the intermediate and foreign-host carriers, we have already discussed the results of our experiments with pigeons, sparrows, common rats, barn and field mice, which show quite conclusively that the most of them at least may be implicated and serve as media of transmission of the disease.

Studies with Soils, Manure, Fly Larvae and Angle Worms

The tenacity with which the avian organisms appeared to carry on in a viable condition on many farms where we practiced systematic testing as previously stated, strongly suggested that an inquiry be made regarding the longevity of these germs in the soils, manure piles, dead carcasses and possibly other depots and reservoirs outside of the infected living birds. Accordingly, about two years ago, several studies were projected along this line. Although many of them are still in progress and far from completed, some preliminary results can be reported at this time.

A number of fowl carcasses, presenting various degrees and stages of avian infection, as well as the infected organs from diseased birds and young vigorous cultures propagated upon suitable artificial media, were buried at different depths in soils

and manure piles, or mixed with soils under varying conditions and maintained for subsequent viability tests at different periods of time.

As limitations in both space and time will not permit a report of specific and detailed results, it suffices to say in a general statement that the organisms under the foregoing conditions have in a majority of cases proven viable and virulent after three, six, nine and, in a couple of instances, twelve months of such treatment and exposure. It is regretted on our part, that the exhaustion of some of the prepared material has been a restraining factor in this particular work, entailing considerable delay in necessitating a repetition of the experiments.

The Fly Larvae Developed in Infected Fowl Carcasses Apparently Transmit the Disease

In connection with this line of experimentation some of the carcasses of infected birds were placed on the ground in November and left there until the following spring. In some of the carcasses which had been unprotected, several fly maggots had developed by the middle of the following April. These fly larvae were fed to two non-reacting chickens, one of which became emaciated and died about three months later, manifesting slight miliary tuberculosis in both liver and spleen. The remaining bird died early in the experiment, of sarcomatosis of the liver.

Angle Worms Fail to Transmit the Disease

About 500 large vigorous angle worms were obtained from the side-walks following a warm shower in May of the present year. They were immediately placed in a large pail of soil that was richly seeded with young avian tuberculosis cultures. The soil was kept well moistened by addition of water from time to time and the worms were kept in the soil for about four weeks. They were then removed from the contaminated soil and placed in a pail of clean soil once a week for four consecutive weeks, which we thought was sufficient opportunity for the worms to cleanse their exteriors of any avian organisms that may be clinging thereto. At this time they were washed carefully in physiologic salt solution and fed to four non-reacting chickens. Three monthly tests on these birds have failed to elicit any positive reactions and it would appear that the worms have failed to transmit the disease in this manner.

PRESIDENT VAN ES: I understand Dr. Kiernan is prevented by illness from being here. I wonder if some one will present his report in his stead.

DR. J. I. GIBSON: With your permission, I will read a short resolution at this time and I will then tell you who is to read the paper.

"We have learned with deep regret of the recent illness of our esteemed friend, Dr. J. A. Kiernan, chief of the Tuberculosis Eradication Division of the Bureau of Animal Industry. We have also been delighted to hear of his convalescence, which we trust shall be speedy and complete.

"(Signed) O. E. DYSON,
Secretary of the United States
Live Stock Sanitary Association."

I move the adoption of this resolution by a rising vote.

. . . The motion was seconded and carried by a rising vote. . . .

DR. GIBSON (continuing): I am pleased to inform you that Dr. A. E Wight has the paper and will substitute for Dr. Kiernan. (Applause)

. . . Dr. Wight read the paper. . . .

A GENERAL SURVEY OF THE NATIONAL TUBERCULOSIS ERADICATION WORK

By A. E. WIGHT, *Washington, D. C.*

Assistant Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, U. S. Department of Agriculture

A decade ago, or, to be exact, on December 3, 4 and 5, 1917, among others there appeared before this Association Dr. J. A. Kiernan, recently appointed chief of the new Tuberculosis Eradication Division of the Bureau of Animal Industry. Dr. Kiernan's subject at that time was the eradication of tuberculosis from cattle and swine. After pointing out the serious losses sustained by live stock owners, the following significant statement was made: "Tuberculosis can be eradicated from all the cattle and all the swine in the United States." This statement was based upon data collected by Bureau representatives in cooperation with various live stock owners throughout the United States, but principally in Maryland, Virginia and the District of Columbia. Dr. Kiernan's paper included outlines of the eradication plans under the individual herd plan, the circumscribed area plan, and the eradication of the disease from swine.

At this same meeting the original uniform methods and rules were adopted and submitted to the respective live stock sanitary officials of the separate states and to the federal bureau. This adoption of a uniform plan was regarded as the consummation of the desires of all interested in the betterment of the live stock industry of the Nation.

After ten years of conscientious application to the carrying-out of these uniform methods and rules by a vast majority of

the live stock owners and the cooperating state and federal officials, it seems quite fitting that this report should assume the form of a survey of the situation as it exists today.

Incidence of Tuberculosis Among Live Stock

At the time of the 1917 report, it had been ascertained, as a result of federal meat inspection statistics, that the cattle of the United States were infected to the extent of 2.4 per cent. The swine, as a result of the slaughter of approximately 40,000,000, were found to be nearly 10 per cent infected. The incidence of the disease among swine continued to increase until 1924, when 15.2 per cent were found to be infected, since which time it has been gradually reducing until, in 1927, it was 13.5 per cent.

The disease in cattle in 1927, as a result of these same statistics, exclusive of reactors killed, was reported as being 1.1 per cent.

It is believed that this marked decrease in infection among both cattle and swine has been accomplished as a result of the intensive eradication work carried on.

Accredited-Herd Work

The early inception of the work, while including the area plan of eradication, saw the individual or accredited-herd plan as being of paramount interest. It is quite fitting that this should have been the case, as it is unquestionably true that the many thousands of owners of outstanding herds of cattle throughout the forty-eight states of the Union were largely responsible for the development of the interest in the work and the later development of the area plan.

As a result of the first year's work, 204 herds were found to be accredited on June 30, 1918. These rapidly increased in number until, on November 1, 1927, there were reported, as a result of the cooperative work, more than 142,500 accredited herds, including more than 1,970,000 cattle.

It has been interesting to note throughout the period of 10 years that in at least 95 per cent of all retests of these herds, the work has stood up and the herds have been eligible for reaccreditation on retest. The greater percentage of those in which evidence of tuberculosis was found, and in which histories were available, showed that the cause of reinfection was due to the introduction of cattle from unknown or doubtful sources, or

other failure to comply in spirit and letter with the provisions of the uniform plan.

Accredited-herd work should be continued. In the succeeding years many hundreds of counties will be subject to tests for reaccreditation purposes, and unless a nucleus of interested individuals in the form of the owners of accredited herds are left in the county, it may be difficult in some cases to secure the necessary cooperation to have reaccreditation tests applied.

In addition to the accredited herds, there were on the list, on November 1, 1927, more than 1,650,000 once-tested-free herds, including those maintained under the area plan. The cattle in these herds numbered nearly 13,600,000. The total herds under supervision on the same date were approximately 1,959,000, containing more than 18,600,000 cattle. Table I shows the growth of the work from 1918 to November 1, 1927.

TABLE I—*Growth of tuberculosis eradication work*

FISCAL YEAR	TOTAL ACCREDITED		TOTAL ONCE-TESTED-FREE*		TOTAL UNDER SUPERVISION	
	HERDS	CATTLE	HERDS	CATTLE	HERDS	CATTLE
1918	204	6,945	883	22,212	—	—
1919	782	19,021	6,535	117,243	—	—
1920	3,370	82,986	16,599	197,577	—	—
1921	8,201	193,620	49,814	643,233	71,806	1,195,797
1922	16,216	363,902	161,533	1,548,183	212,182	2,616,395
1923	28,526	615,156	312,281	2,724,497	400,097	4,449,722
1924	48,273	920,370	529,018	4,772,836	705,906	7,374,093
1925	72,383	1,275,063	921,758	8,047,540	1,120,526	11,392,381
1926	96,392	1,577,087	1,304,432	10,658,259	1,556,366	15,131,345
1927	130,476	1,885,072	1,533,518	12,741,520	1,817,514	17,600,380
1928†	142,549	1,972,624	1,659,115	13,597,183	1,959,767	18,610,865

*Includes area work.
†To November 1.

CIRCUMSCRIBED AREA WORK

The inspiration derived from the testing of individual herds and the establishment of them as fully accredited led, in 1922, to the inauguration of the area plan. In order to conduct such extensive testing as is contemplated under the area plan, much legislation, on the part of the state legislatures, and additional funds were absolutely necessary. Starting in a small way, this plan has developed until, on November 1, 1927, there were in the United States 401 counties and 16 townships which were classed as modified accredited area. Based upon the number of counties in the United States, these 401 counties constitute 13

per cent of the entire number. Exclusive of modified accredited counties, there were 627 others engaged in the work looking to modification. This total of 1,028 counties, either modified or working, constitutes one-third of the total counties in the United States.

Most noteworthy during the past year is the fact that a number of states enacted legislation enabling a much more intensive plan of work. New states obtaining this legal authority were Connecticut, Massachusetts, New Jersey and Tennessee. Among the states obtaining additional legislation, Indiana obtained a law requiring that wherever a county adjoins two counties working or having completed area work, such county shall provide operating funds upon the request of the State Veterinarian. This is, in effect, a complete state law, as under it all counties in the State will eventually be required to make the necessary appropriations. At this time, 59 of the 92 counties in Indiana are either modified or working under the plan.

Other states are following the plan of testing contiguous areas, as is evidenced by the recent accreditation of thirteen counties practically adjoining in the state of Wisconsin. This area includes 12,487 square miles, and the cattle population therein is approximately 600,000. This area compares in size with the combined states of Maryland, Delaware and Rhode Island, or the combined area of Connecticut and New Jersey, and the cattle population is approximately twice the number contained in either of the groups mentioned.

It is also to be noted that at least one state, namely, North Carolina, will, without doubt, be 100 per cent modified within the ensuing twelve months, there being now only eleven counties to be completed. South Carolina, among other southern states, is making progress, and is doing it by the successive testing of adjoining counties. Michigan, Iowa and a number of other states are approaching completion.

Of especial interest in connection with area work during the 12-month period is the reaccreditation of areas previously put in the modified accredited class. Under the Uniform Methods and Rules, certain standards are established, and it is noteworthy that in the thirty-nine counties which have been subjected to tests, either in whole or in part, for reaccreditation purposes, not a single one has failed to qualify again. This is contrary to the prediction of the opposition, which claimed that such areas could not be maintained as relatively free from disease. In con-

nection with this reaccrediting work, it is recommended that during the period between modification and retesting, every effort should be made to exclude doubtful cattle from gaining entrance into the county, and that the previously infected herds should be retested at frequent intervals.

As a final word on the circumscribed area plan, it may be observed that in every state where a definite program has been determined upon, and plans laid for its enactment, the work has not only grown rapidly but, generally, has met with approval. The wholehearted cooperation between the respective states and the Bureau in carrying out the provisions of the uniform plan should be continued, and this cooperative spirit enlarged upon in order that the entire area of the United States may eventually be declared as a modified accredited area. The state live stock sanitary authorities are today in a much better position to estimate the extent of bovine tuberculosis in their respective states than ever before, and can recommend and carry out plans that will accomplish the desired result to the best advantage of all concerned.

Tuberculosis in Swine and Poultry

Continued interest in tuberculosis of the avian type, and particularly in its transmission to swine, has been indicated during the past year. Many states, following the adoption of a working plan at the last meeting of this Association, inaugurated some control measures. Much tuberculin-testing of fowls has been done in these states, the idea being, principally, to determine the possibilities of the test, the necessary follow-up measures to be inaugurated when infection is determined in the flock, and the results obtained from the postmortem examination of many tuberculous fowls. Great stimulus, of course, was added to this work because of the premium of ten cents per hundredweight offered by the packers for swine from modified areas. This is particularly true as regards the hog-raising states of the Corn Belt.

Incident to the studies inaugurated elsewhere, the Bureau, during the last year, made a limited survey of the extent of avian tuberculosis by means of the tuberculin test. The purpose of this survey was, principally, to obtain information relative to the possible extent of the disease in the states believed to be relatively free. Nine states, wherein the infection was known to be rather high, were not included. Of the remaining 39 states,

27, as the result of the testing of 1,474 flocks, reported some disease in the poultry. Approximately 25 per cent of these flocks were found to be infected to some degree. More than 85,000 birds were tested, resulting in over 9,300 reactors being obtained.

In addition to this tuberculin-testing survey, a questionnaire was set to several thousand poultry-owners through the Bureau field offices, from which more than 3,100 replies were received. The thought behind this questionnaire was to ascertain under what conditions poultry flocks were being maintained, and the possible connection such maintenance conditions might have upon the transmission of the disease from flock to flock. A summary of the replies failed to furnish this information. However, it was apparent that the poultry industry, as a whole, was not so fully informed relative to avian tuberculoisis as it should be, and that much more educational work was necessary.

The usual physical examination of farm flocks incident to the tuberculin-testing of the cattle was continued. During the fiscal year 1927, inspections were made of more than 211,600 flocks, containing over 16,500,000 birds. This gross inspection indicated nearly 6 per cent of flock infection in the states covered by the report.

From recent letters received by the Bureau, it is noted that the state of Kansas expects to start a systematic plan of testing enough hogs and fowls in one county to determine the extent of the disease. This work will be done in Jefferson County, commencing the week of December 5.

A report from the state of Ohio, recently received, is of considerable interest, as it indicates: first, that avian tuberculosis is not so extensive in some localities as had been expected; second, that the owners in nearly all instances where the disease is demonstrated will readily carry out instructions in regard to control and eradication methods; third, that it is not practicable to test all fowls with tuberculin; and fourth, that avian tuberculosis can be controlled and eradicated under a campaign of inspection, testing and sanitation. It is noteworthy in this Ohio report, that the local practicing veterinarians are taking a prominent part in the eradication of avian tuberculosis, and, further, that the plan has not been carried on independently as a separate project.

The state of Iowa, likewise, has followed a practicable course, as is indicated by a quotation from a report received from that state as follows: "First, that a definite course looking to the

eradication of avian tuberculosis has been mapped out and is being followed in the state of Iowa." Succeeding items in this same report indicate that the plan of raising new flocks on clean ground, and the slaughter of the diseased flock have met with favor; further, that all agencies interested in the poultry industry are cooperating, and that the State Department of Agriculture, charged with the responsibility of the control of disease, is assuming the direction of the work; and further, that it is anticipated that an average of not less than 500,000 birds will come under the inspection of the regulatory veterinarians each month. More than 3,500,000 birds have been inspected during the six months the plan has been in operation.

A Michigan report covers the resurvey of 286 farms where infection had previously been found in the poultry. These were located in three counties. This revisit showed that 60 per cent of the infected flocks had been disposed of and the premises had been cleaned in accordance with the recommendations given by the state and federal forces. This is especially valuable informations and indicates a good measure of success in the eradication work being carried on. This report also emphasizes the desirability of the owner's disposing of the entire flock, once infection is disclosed. The question is also asked in this report as to what recommendation should be made to owners relative to the securing of healthy birds to replace those disposed of as diseased.

A report from Indiana also indicates a considerable amount of preliminary educational work in the form of clinics and postmortem examinations.

The state of Missouri reports the tuberculin-testing of some 10,000 birds, with about 10 per cent reactions. The inspector making these tests noted that guinea fowls were nearly always badly infected with tuberculosis. One county which was completely tested during the year with less than one-half of one per cent infection in the cattle, reports a considerable degree of infection in the swine, and that the poultry were badly diseased. This is in keeping with similar reports from other states.

A motion picture depicting the avian tuberculosis problem has been made by the Department, and will be available for use in the near future.

The above items, and other reports received later, indicate an increasing interest on the part of the live stock sanitarians in the control and eradication of the disease from poultry. They further indicate that there is a real demand from the poultry

industry that this matter should be given immediate attention. It is believed that under the plans now in effect, and with the work being conducted simultaneously with the testing of cattle, marked progress will be reported in the near future.

Milk Ordinances

In his report last year, Dr. Kiernan mentioned a survey regarding the number of towns and cities in the United States which, by ordinance, required the tuberculin-testing of dairy herds. These figures indicated that 1,249 such towns and cities, by ordinance, required such testing.

During this year a resurvey has been made by the Bureau, in cooperation with the United States Public Health Service and the Bureau of Dairy Industry. The Public Health Service officials made the survey in those cities and towns of 10,000 population or over which had health officers. The Bureau, through its field offices, made the survey of those cities and towns with populations under 10,000. A uniform questionnaire was used by both agencies. This survey has not as yet been completed, but indicates that there will be approximately 2,000 towns and cities on the new list. This indicates a marked increase in the interest in the eradication plans as they relate to public health measures.

Tuberculin Testing

The proper application of the various tuberculin tests continues to present itself as a very important matter, requiring the constant attention of live stock sanitarians. Reports are too frequently received indicating that possibly some carelessness is being exhibited on the part of a few operators, resulting in criticism of the test methods. It is not too late in the movement to emphasize again the necessity for the most careful technic being used in all tests. Since the inception of the work more than 42,000,000 tuberculin tests have been made. To the thinking operator each succeeding test presents a new problem. When it is noted that during the month of October, 1927, more than 1,000,000 cattle were tested under the plan, the enormity of the supervision of this work is realized. Incidentally, this is the largest month's testing reported since the work began.

In connection with the application of the tuberculin tests, the subject of so-called no visible lesions is involved. It is the unqualified opinion of many skilled operators that if all of the

requirements regarded as necessary in the proper injection of tuberculin by the intradermic method are carried out, together with a subsequent study of the herd and the individual members thereof, particularly in so-called lightly infected areas, many no-lesion cases will be eliminated. It is obvious that the skillful application of the test will have much to do with the ultimate outcome of the campaign. It is therefore strongly recommended that all live stock sanitarians, either federal, state or county, give a full measure of attention to this phase of the work. Table II shows in detail the tests made in 1917 under the cooperative plan, the reactors found and the infected premises in each state.

Salvage and Indemnity

The question of the proper salvage and the payment of indemnity continues to be an important one. It is especially noteworthy that during the past twelve months reactor cattle commanded very good prices when sold on the open market. This is particularly opportune because of the ability to extend the federal and state appropriations to cover the greatly increased amount of testing. However, despite the satisfactory sums being obtained, it is very necessary to continue a close supervision, particularly in the areas in which many reactors are being obtained. Monthly reports showing the averages in each state are distributed. The state and federal appropriations for the present fiscal year, ending June 30, 1928, are approximately $18,500,000, to be used for both operating expenses and indemnity.

Opposition to Tuberculin-Test Methods

As the work has continued to grow in volume, the open opposition of a very small minority of the cattle-owners has attracted undue notice. A summary of state laws and regulations does not disclose in any state any so-called compulsory test methods, other than those involved in purely local-option procedures. Therefore, references in the daily papers, inspired by organizations opposed to area work, to compulsory test methods are unfair. It would seem proper to recommend here that local evidences of opposition be allowed to run their natural course without undue official notice, until the opposition is silenced by correct information and other constructive sentiment. Despite these occasional centers organized for opposition purposes, it is noteworthy that in no instance has the work been permanently interrupted.

TABLE II—*Record of tuberculin-testing. Cooperative tuberculosis eradication work. Fiscal year 1927**

STATE	HERDS TESTED	CATTLE TESTED	REACTORS FOUND	PER CENT REACTORS	INFECTED PREMISES
Alabama	3,486	56,277	174	.3	58
Arizona	4,196	47,979	744	1.5	388
Arkansas	1,248	11,606	49	.4	33
California	1,574	69,124	853	1.2	236
Colorado	1,691	17,617	355	2.0	211
Connecticut	5,046	80,429	6,437	8.0	1,373
Delaware	1,520	17,575	1,667	9.5	339
District of Columbia	22	669	2	.3	2
Florida	1,236	41,393	303	.7	95
Georgia	2,594	32,484	78	.2	38
Idaho	4,818	92,106	402	.4	142
Illinois	71,695	739,924	31,672	4.3	8,495
Indiana	41,643	330,309	2,637	.8	1,377
Iowa	46,726	760,824	17,827	2.3	6,949
Kansas	21,899	255,250	2,330	.9	1,412
Kentucky	15,044	78,719	341	.4	192
Louisiana	2,913	49,656	1,112	2.2	290
Maine	15,902	101,165	722	.7	336
Maryland	10,234	108,914	5,290	4.9	1,737
Massachusetts	2,561	45,928	5,859	12.8	967
Michigan	65,722	518,969	9,196	1.8	4,630
Minnesota	44,344	896,291	18,869	2.1	7,748
Mississippi	3,729	40,201	135	.3	36
Missouri	2,252	30,182	149	.5	38
Montana	5,822	105,574	398	.4	151
Nebraska	29,028	376,995	3,196	.8	1,884
Nevada	1,106	15,853	105	.7	53
New Hampshire	5,385	70,908	4,382	6.2	1,053
New Jersey	3,974	57,010	2,422	4.2	449
New Mexico	59	1,128	4	.4	4
New York	73,932	815,746	67,631	8.3	16,542
North Carolina	33,809	103,489	188	.2	147
North Dakota	11,585	200,941	2,086	1.0	890
Ohio	68,773	483,863	16,262	3.4	5,580
Oklahoma	387	17,854	103	.6	35
Oregon	20,134	143,627	1,171	.8	489
Pennsylvania	51,529	392,093	16,841	4.3	4,898
Rhode Island	296	7,263	1,298	17.9	160
South Carolina	14,526	42,258	115	.3	50
South Dakota	8,884	174,459	2,841	1.6	1,218
Tennessee	3,030	27,212	101	.4	41
Texas	499	22,569	321	1.4	94
Utah	12,493	64,578	561	.9	467
Vermont	7,813	151,980	4,494	3.0	953
Virginia	8,190	64,907	753	1.2	298
Washington	14,148	139,424	2,645	1.9	932
West Virginia	16,391	64,825	855	1.3	369
Wisconsin	67,455	1,266,797	45,040	3.4	10,276
Wyoming	1,107	15,010	73	.5	42
†Hawaii	1,635	49,264	1,062	2.2	§
Interstate	37,476	440,958	3,210	.7	§
Totals	871,561	9,700,176	285,361	2.9	84,197

*Includes records of tuberculin-testing done under the area plan.

†All since 1923 not previously reported. §Figures not available.

Where necessary to combat organized propaganda untruthful in character, it can be pointed out that freeing herds from the disease of tuberculosis is not the only benefit derived from the campaign. Surveys made in counties prior to the conduct of the work, and after all the cattle have been tuberculin-tested, have conclusively shown vast improvements in the herds located therein. Many owners of dairy herds have voluntarily stated that they are obtaining more milk from the herds consisting of a lesser number of cattle than they had previously received from the old herds consisting of a greater number of animals.

In the average dairy herd in an infected territory the tuberculin-testing has aided in weeding out low-producing animals and substituting therefor more profitable ones. Many so-called calf illnesses and other diseases, partially or wholly due to improper and insanitary housings, have been overcome. In the beef breeds much has been accomplished in the elimination of the undesirable breeding animals.

Conclusion

In conclusion, it is apparent, from the status of the work, after ten years of effort, that the prophesy made in 1917 relative to the possibility of controlling and eradicating this disease is being borne out. However, it is well to guard against a feeling of over-optimism, and to emphasize the necessity for a continuance of the determination to eradicate this disease completely as early as possible. As pointed out, definite state programs will accomplish this result. On the other hand, if a feeling of security is permitted to exist to the detriment of the organized efforts, dire results may yet obtain in some localities. A continued feeling of determination and fighting spirit is vitally necessary.

President Van Es: Before the Chair opens the subject of tuberculosis for discussion, we will listen to a brief report by Dr. Cotton. He has something to communicate, he says, and if he is not too long-winded, we will listen to him. (Laughter)

Dr. C. E. Cotton: Mr. President, I assure you it won't be very long.

You perhaps will recall that two years ago I presented a paper which included some of the legal phases of tuberculosis control. At that time, if you will remember, we referred to two cases which had gone through our Supreme Court, decided favorably for the State, but the people interested substituted another suit in order that it might be taken to the United States Court. It was decided on the thirty-first day of October of this year by the United States Supreme Court.

I simply prepared a short statement, following out the material I presented two years ago, and I have included the citations of the Supreme Court cases, but am unable to give you any citation of the United States court, because it is not yet available.

I would like to read the decision of the United States Supreme Court; it is very short: "Dismissed for want of a substantial federal question," referring to other decisions made by the United States court. That was their decision. I have included in this article the three cases of Supreme Court decisions to which this decision refers. I have also endeavored to give credit to the Attorney-General's office, and particularly the Assistant Attorney-General who has given all of his time, and to whom we feel we are indebted for the results of our case.

I have also included a short statement that he has prepared for our farm press, in which he refers to the importance of this decision, and how important it may be to other states that may be involved in like cases. I will not bother you to go through with this, but I hope it can be printed in the report.

LEGAL PHASES OF TUBERCULOSIS CONTROL

By CHARLES E. COTTON, *St. Paul, Minnesota*

Secretary and Executive Officer, Minnesota State Live Stock Sanitary Board

At the annual meeting of this Association in 1925 I presented a paper in which was included a history of the legal cases initiated by a few of the farmers and owners of live stock, who attempted to prevent the application of our state law providing for the control of tuberculosis by counties under the Area Plan. The paper included extracts from the decisions of the Supreme Court of the state of Minnesota.

The first case instituted was an injunction to prevent our carrying out the provisions of the law, which was decided by the Supreme Court in favor of the State (Citation, Schulte et al v. Fitch, 162 Minn. 194,202 N. W. 719).

For the reason that the decision in this injunction case was final and could not be appealed to the United States Court, the plaintiffs instituted another action and the decision of the State Supreme Court also was in favor of the State (Citation, 166 Minn. 498,207 N. W. 639).

Since that time the Supreme Court of Minnesota has again rendered a decision, sustaining the Area Tuberculosis Control Law of Minnesota (Citation, State v. Lincoln County, 169 Minn. 145,210 N. W. 635).

The Schulte-Fitch case was appealed to the United States Supreme Court, where it was argued on October 28, 1927, and the decision was filed on October 31, 1927. I am unable at this time to furnish the citation.

The complaint of the plaintiffs, charging that our state law provides for the taking of property without due process of law, and denying the plaintiffs equal protection of the law, was decided by the United States Supreme Court as not presenting a

federal question. In this case, all the Supreme Court said, in its opinion, was the following:

> Dismissed for want of a substantial federal question on the authority of Shulthis v. McDougal, 225 U. S. 561,569; Hull v. Burr, 234 U. S. 712,720; Norton v. Whiteside, 239 U. S. 144,147.

In the Shulthis case the United States Supreme Court stated:

> A suit to enforce a right which takes its origin in the laws of the United States is not necessarily, or for that reason alone, one arising under those laws, for a suit does not so arise unless it really and substantially involves a dispute or controversy respecting the validity, construction or effect of such a law, upon the determination of which the result depends. This is especially so of a suit involving rights to land acquired under a law of the United States. If it were not, every suit to establish title in land in the central and western states would so arise, as all titles in those states are traceable back to those laws.

In the Hull case the Court said:

> The rule is firmly established that a suit does not so arise unless it really and substantially involves a dispute or controversy respecting the validity, construction, or effect of some law of the United States, upon the determination of which the result depends. And this must appear not by mere inference but by distinct averments according to the rules of good pleading; not that matters of law must be pleaded as such, but that the essential facts averred must show, not as a matter of mere inference or argument, but clearly and distinctly, that the suit arises under some federal law.

And, in the Norton case the Court said:

> This, however, does not suffice to solve the question since it is settled that a mere formal statement to that effect is not enough to establish that the suit arises under the Constitution and laws of the United States but that it must appear that "it really and substantially involves a dispute or controversy respecting the validity, construction, or effect of some law of the United States, upon the determination of which the result depends. And this must appear not by mere inference, but by distinct averments according to the rules of good pleading. . . ."

The Assistant Attorney General of Minnesota, Victor E. Anderson, advises that the opinion of the Supreme Court of the United States shows that the Court did not really get down to considering the merits of the case, if there were any, since it held that the complaint and showing made thereunder did not involve or present a substantial federal question, and it is safe to assume that should another case involving similar matters reach the United States Supreme Court, it would dispose of it in the same manner as was done in this case.

The Live Stock Sanitary Board of the State of Minnesota, and we trust the control men of every state in the Union, fully appreciate the services of Clifford N. Hilton, the Attorney General of the State of Minnesota, and particularly the assistance of Victor E. Anderson, the Assistant Attorney General, who has been very much interested in our sanitary control work in Minnesota and has given his time unstintingly in these legal cases.

The following is a statement prepared by Mr. Victor E. Anderson, relative to the decision of the United States Supreme Court, which he has prepared for the farm press, and I am sure it will be of interest to the members of this Association:

The eradication and control of bovine tuberculosis in Minnesota has been a matter of official concern and public interest ever since 1903 when the State Live Stock Sanitary Board was created. Ever since that time it has taken a lead in this respect. Public funds have each succeeding legislative session been increased for this purpose and the first "accredited herds" in the United States were here certified. Though very far-reaching and definite results were accomplished under the so-called "Herd Plan," yet in 1923 the Legislature determined that the "Area Plan" should also be put into effect in this state. This law went into effect in April, 1923, and on May 8, 1923, the Sanitary Board, for the State, entered into a cooperative contract with Meeker County for the compulsory testing of all cattle in that county under the Area Plan. Other counties followed in short time and the work began with such force and effect that the most satisfactory results were to be expected. Certain farmers in Meeker County then brought a suit against the State Live Stock Sanitary Board and the Board of County Commissioners to restrain the enforcement of the law under the claims, (1) that the law was an undue interference with the business and affairs of the farmers; (2) that it provided for unequal taxation; (3) that it denied to the people of our state the equal protection of the law; (4) that it was for a private purpose and only benefited the cattle-owners; (5) that it denied to the farmers "due process of law," and (6) that it could not be enforced. The case was begun in Meeker County and the Judge of the District Court there granted a *temporary restraining order*, which enjoined the Sanitary Board to proceed with the testing of cattle in that county ar anywhere else for that matter. The case was transferred to St. Paul where, upon hearing had, Judge Sanborn set aside the *restraining order* and held the law valid. From this decision an appeal was taken to the State Supreme Court, where the decision was affirmed and where the Supreme Court said in reference to tuberculosis:

> "That tuberculosis is a dangerous, contagious or infectious disease which attacks both human beings and domestic animals; that it is prevalent throughout the state among both human beings and domestic animals, and that it is communicated to human beings, especially to children, by milk and other food products from infected animals, stand undisputed. The object of the statute is to promote and preserve the public health by providing a means for the control and suppression of this disease among cattle. That it is for a public purpose is beyond question."

In holding that the law was for a *public purpose*, and not a private one, as contended by the cattle-owners bringing the suit, the Supreme Court also said:

> "That the preservation of the public health is one of the duties devolved upon the state, as a sovereign power, cannot be successfully controverted. In fact, among all of the objects sought to be secured by law, none is more important than the preservation of the public health, and an imperative obligation rests upon the state, through its proper instrumentalities or agencies, to take all necessary steps to promote this object. . . *It is as much for the interest of the state that the public health should be preserved as that life should be made secure!*"

The Supreme Court also held that the law came well within all of the constitutional limitations and complied with all such provisions, and that the Sanitary Board could make any rule or regulation it deemed expedient for its enforcement and that it was a criminal offense not to comply with such rules and regulations.

It was thought in view of this sweeping decision that the cattle-owners would be content and allow the law to be enforced without further resistance, but this proved not to be the case. It was therefore necessary to try the lawsuit on the merits and upon such trial Judge Hanft again sustained the law and ordered it enforced. The case was again taken to the State Supreme Court from the final judgment entered therein, in order that if the Supreme Court again sustained the law an appeal could be taken to the United States Supreme Court. The State Supreme Court promptly dismissed the second appeal and stated that the decision made in the first case was the law of the state and the settled policy of Minnesota. The case was thereupon taken to the United States Supreme Court on a writ of error, under which the same claims were made which were first contended for in the State Supreme Court. The United States Supreme Court in this case for the first time had an opportunity of passing upon the validity of the eradication of tuberculosis under the "area plan" and under a law compelling the cattle in a county to be tuberculin-tested. That court however held that the decision of the State Supreme Court was *final* and *conclusive* and that the law was valid in every respect and was not in conflict with any constitutional provisions of the federal constitution. The appeal was dismissed as wholly without merit and, as stated, the act fully sustained. This decision settles for *all time* the validity of the law involved and shows definitely that the United States Supreme Court is not going to consider or tolerate any attack upon such a beneficial legislative enactment. With favorable decision obtained in every case where the law has been attacked the Live Stock Sanitary Board will be able to proceed more rapidly to complete the eradication of tuberculosis in this state and the decision in the Meeker County case will also furnish a basis for the sustaining of the laws in other states to the same effect.

With public sentiment everywhere increasing for the eradication of bovine tuberculosis there can be no question but what the only limitation will be the amounts of appropriations (both state and federal) for indemnity. However, during the past five years appropriations have greatly increased and the most far-reaching benefits will soon be at hand. Of course, in the counties which have already been accredited as "modified free areas" dairy products and live stock bring a much higher price in the markets.

Should the attack against the law have been sustained the whole structure in this important work would have been torn down, and it is indeed hard to speculate how this work could have been carried on; but with such sweeping victory obtained, there is nothing left to obstruct the complete eradication of bovine tuberculosis in our state. Since other states now also have the "area plan" in effect, no doubt the results there will be equally satisfactory, and we know of no more important and far-reaching action that will bring as much lasting benefit to our farmers as the final victory in the United States Supreme Court.

PRESIDENT VAN ES: The Chair has somewhat hurried the last two speakers so that there may be ample time available for discussing the long series of valuable contributions on tuberculosis. I think we have ample time left to do so.

I promised Professor Smith I would call on the gentleman who wanted to say something about tattooing, and I will do that first, in order to redeem that promise. Who is your man, Professor Smith?

MR. SMITH: Mr. R. L. Cuff, of Kansas City.

MR. CUFF: Professor Smith asked me to tell you something about the attitude of the people regarding tattoo-marking of hogs. I know just about how you feel when any innovation comes in. We put up our hands in holy horror and say, "It will not work." That is what we think. I was of the same opinion when we started in. The first time I went out in the yards to mark any hogs, I met the packers' buyers, and said, "We want to try this."

When they looked at the tattoo-marker and saw the prongs sticking out, they shook their heads and said, "You are going to bruise the meat!" They went on at that rate. There was the first encouragement we got. I went over and saw one of the heads of the packing company and told him we would like to try it out, and we did try it out. They got the head of the department, superintendent, and about everybody else together, cut into those lesions or marks to find out whether or not there was any bruising. They were perfectly satisfied. That was all right. The next thing they said was, "It is all right, but you can't get the people to do it." We did not know whether we could or not. There were no rules or regulations requiring anybody to do any tattooing, so I went down and saw Mr. Mercer, of Kansas, and asked him about it. He said he believed it would be a good thing.

"We have about three counties we would like to get organized to do the tattoo work."

"All right, go ahead."

We went out and saw several shippers in those counties. All except one in those three counties volunteered to come in and tattoo their hogs. There was one fellow who said he would just as soon as the railroad fixed up the yards in that particular town. Those yards are about fixed now.

We went at them with this idea: It was for themselves and for tuberculosis eradication, and not connected with hogs so much; it was just to help them locate the stuff on their own farm.

I took Dr. Gibson on a ride one day, up through Jackson County, Kansas. We started out, and the first shipper we came to was a man who ships about as many hogs as any man in that state. He said, "There is an Irishman who lives up on the hill, don't go near him. He is against it." He had some hogs that were tuberculous. We thought we had better go and get his attitude.

We saw him. He had just come in from fixing the fence. The cattle had broken over into the cornfield. That was against us. When he found that his hogs were tuberculous, he said, "I am glad to know it. I have had my cattle tested since I heard of this report, and had no reactors. But I am sure glad to know that I have tuberculosis. What would you suggest that we do to clean up?"

Here is a little bit of evidence I wish Professor Smith had shown you. Here are the reports we get from the packing companies on the retentions of hogs, and here are some hogs from a certain county in a certain state, 59 hogs, and the amount of premium, the commission firm and shipper and his address, and number of hogs infected with tuberculosis. Out of the 59 there were 30 tuberculous. Heads sterilized, 2; heads condemned for tuberculosis, 2; viscera sterilized, viscera condemned, 23; carcasses sterilized, 9; carcasses condemned, 13. That was a lot shipment. You can do absolutely nothing with that.

Dean Dykstra, if you and your neighbor here lived on a farm, and you both raised hogs, and we were to come back with that report, and you two fellows had shipped the load, you would say it was your neighbor, and he would say it was you. Neither one of you would believe it.

Here is another one that helps out much more. Here is a shipment of sixty hogs that came from ten different owners. There were thirteen retentions, and there were five different fellows who had hogs retained in that load, and they are listed right down here, as Professor Smith told you. There was no question about it. Just go right back to that farm and you can absolutely locate it. There are no two people who will ever have the same mark. We found it is a very, very good and complete means of identification.

You heard a little bit about the shipper buying these hogs. We had a queer experience. One noon a man called up from Fort Worth, Texas, and said, "What is the matter with those two carloads of hogs that came from Kansas City?"

The man at the other end said, "Why?"

"Well, you know, there is a whole lot of letters and numbers on the backs."

"Those are hogs from an accredited county."

"What is an accredited county?"

"I will tell you. I can not explain to you over the telephone, but you get any numbers of those hogs that are retained as tuberculous and let us know."

We have gone around in different counties and asked the shippers what they really thought of the tattooing. They have been tattooing (about thirty of them) for a considerable length of time. We have had them say this: "When we started out we thought this was going to be an awful job, but now we have gotten so we can get the hogs on the scales, and all we do is hit them on the back. There isn't much to it. Our folks really want to know whether their hogs are clean or whether they are infected with tuberculosis."

In conclusion, I want to give you one instance of what following up really means. Leavenworth County, Kansas, was the first Kansas county to be accredited. It is right near Kansas City, so every lot of hogs that comes from there is slaughtered separately. They are not slaughtered separately, but are tattooed and are all driven together, but they know whose they are. When this county was accredited there was about 5 per cent of the hogs retained. That is a little more than three years ago, and right up to the present time there is less than 1 per cent of all of the hogs that come from Leavenworth County that are infected with tuberculosis. It just shows what a good follow-up will do. I am glad to say that among the people in the three accredited counties who are tattooing, there is a mighty good sentiment toward the marking of the hogs. Before you fellows commend or condemn the system, I wish you would mark a few hogs and let them go to market. Then go to your men and tell them why you are doing it, and I really believe you will make some friends. Thank you. (Applause)

DR. C. H. HAYS: I would like to have the privilege of submitting a report by title. This is a report of tuberculin-testing of poultry flocks in Nebraska. This report follows the paper presented last year in which we gave a brief outline of a plan intended to determine the extent and prevalence in certain defined areas. I submit this by title, so it can be printed in the minutes. (Applause)

A REPORT OF TUBERCULIN-TESTING OF POULTRY FLOCKS IN NEBRASKA*

By C. H. HAYS, *Lincoln, Nebr.*

State Veterinarian

In a paper[1] read before the thirtieth annual meeting of the United States Live Stock Sanitary Association, a plan was outlined which the Nebraska Bureau of Animal Industry proposed to inaugurate in making field surveys in a number of defined areas to determine the extent and prevalence of tuberculosis among poultry flocks. The principal points in the proposed plan included the tuberculin-testing of at least sixty per cent of all flocks of chickens in the selected areas, the units for testing to be precincts or townships of counties which had been certified as modified accredited areas under the bovine tuberculosis eradication program; the entire flock on each premise was to be included in the test; the reacting birds were to be slaughtered under an inspection to be provided by the Nebraska department, except such birds as were found at the time of the

*Bureau of Animal Industry, Nebraska Department of Agriculture, and Bureau of Animal Industry, U. S. Department of Agriculture, cooperating.

test to be physically unfit for marketing; and the premises which had harbored infected flocks were to be cleaned and disinfected under official direction.

Assisted by the United States Bureau of Animal Industry, such a plan was adopted in four precincts of three different counties in Nebraska during 1927. The precincts selected were Silver Creek and Craig precincts in Burt County, located in the northeastern part of Nebraska; Cameron Precinct of Hall County, in central Nebraska; and Lincoln Precinct of Johnson County, in southeastern Nebraska. The geographic location of these areas places them in the grain-producing belt of the central west, corn being the principal crop. In each of the areas named, more than seventy per cent of the flocks were tested, with the exception of Craig Precinct of Burt County, in which area the testing was confined to the northern one-half, but of which portion more than seventy per cent of the flocks were tested.

The tuberculin was applied by the intradermic method, the wattle being the seat for the injection. With a few exceptions, testing was of chickens only. The tuberculin used was produced by the Department of Animal Pathology and Hygiene of the Agricultural Experiment Station of the University of Nebraska. A one-fourth-inch 24-gauge needle was found to be preferable for injecting tuberculin. At the time of injecting tuberculin, each bird so injected was marked with a colored celluloid band placed on one leg, and, as each reactor was determined, such bird was further identified by a metal leg-band bearing a serial number. The observations for determining reactors were made at the 48th hour following the injection of tuberculin, such hour being determined to be the most desirable after readings had been made in a number of flocks at both the 48th and the 72nd hours.

The tuberculous chickens were removed from the flock in which located, immediately at the time when classified to be reactors to tuberculin. Such of the reactor chickens as were determined by physical examination to be unfit for marketing were destroyed, the carcasses of such birds being burned. The reactor chickens passed for marketing were handled under quarantine to the establishment where slaughtered, the same being through cooperation from the agents of the commercial produce company assisting in the disposal of such chickens under postmortem inspection. The owners were paid, by the produce

company, market prices on all birds, the carcasses of which were passed for food.

Summaries of the results of the tuberculin-testing completed, the disposition of reactor chickens and certain other details have been compiled, as hereinafter tabulated, grouping the testing by areas in which completed as well as making a general summary of all testing completed. There occurred seasonal difference as to the time when such tests were applied, and from the results obtained may be measured the rapidity with which the infection of avian tuberculosis may spread.

Classification was made as to the ages of the chickens tested, grouping the birds in two parts, one part comprising the birds over one year old, based in Burt and Hall counties as whether hatched prior to 1926 and in Johnson County as to whether hatched prior to 1927, and the other part obviously of lesser age. Such classification was reasonably correct, but more especially in the earlier testing in Burt County and in the testing in Johnson County. The classification indicates a marked effect of the age factor in the prevalence of tuberculosis in chicken flocks. In the summaries dealing with the disposition of reactors, the unaccounted birds were those which died in transit or during feeding operations, and on which postmortem examination was not made.

The cost of the service has been recorded, because others, who may possibly be considering a similar project, may be benefited thereby. The expense incurred in Johnson County represents more nearly a correct testing-cost, as less interruption and delay were occasioned. The cooperation from flock-owners was more complete, a higher percentage submitting their flocks for test than in the other counties, Hall and Burt. In all instances the expense in organizing, and in assisting in disposal of reactors, and a major part in making postmortem examinations, has been included in the expenditures listed. The expense can therefore be considered a maximum.

A further item entered as a notation gives the incidence of tuberculosis among the cattle when tests were applied under the area plan in the different precincts, and also the cattle herd morbidity-rate of the same areas. One of the requirements, as previously stated, was that bovine tuberculosis eradication to the point of establishing a modified accredited area must have preceded the testing of the poultry flocks.

SUMMARY OF TESTING CHICKENS FOR TUBERCULOSIS AND DISPOSITION OF REACTORS OBTAINED UNDER SUCH TESTING

I. In Silver Creek Precinct, Burt County

Period—January 25 to April 6, 1927

A. Testing Completed

a.	Number of flocks tested	83
	Of same containing reactors	77—92.7%
b.	Number of chickens tested	10,582
	Of same one year or under	6,732—63.6%
	Of same over one year	3,850—36.3%
c.	Number of chickens reactors	883— 8.3%
	Of same one year or under	168— 2.4%
	Of same over one year	715—18.5%

Note: Tuberculin-testing of cattle under area plan on the initial test revealed the incidence of tuberculosis among cattle in Silver Creek Precinct to be 0.5 per cent and the herd morbidity 4.4 per cent. The normal cattle population approximates 100 herds containing 1500 cattle.

B. Disposition of Reactor Chickens

a.	Number of reactors	883
	Destroyed on premises	66
	Slaughtered under supervision	794
	Unaccounted for	23
b.	Number slaughtered under supervision	794
	Condemned as unfit for food	264—33.1%
	Passed for food	530—66.9%
	Showing "no visible lesions"	53— 6.6%

C. Expense Incurred

Salaries	$ 740.50
Subsistence	101.00
Telephone	7.25
Transportation at 8¢ per mile	277.03
Total of items	$1,125.78

Note: Cost of tuberculin, tags and equipment or supplies is not included.

II. In Craig Precinct, Burt County

Period—June 22 to July 13, 1927

A. Testing Completed

a.	Number of flocks tested	37
	Of same containing reactors	29—78.3%
b.	Number of chickens tested	5,518
	Of same hatched spring, 1926	3,326—60.0%
	Of same hatched before 1926	2,192—40.0%
c.	Number of chickens reactors	921—16.0%
	Of same hatched spring, 1926	471—14.0%
	Of same hatched before 1926	450—20.0%

Note: Tuberculin-testing of cattle under the area plan on the initial test revealed the incidence of tuberculosis among cattle in Craig Precinct to be 1.5 per cent and the herd morbidity rate at 13.9 per cent. Upon retest of all herds the incidence was shown to have been reduced to 0.29 per cent and the morbidity rate to 4.2 per cent. The normal cattle population approximates 235 herds, containing 3500 cattle.

B. Disposition of Reactor Chickens

a.	Number of reactors	921
	Destroyed on premises	32
	Slaughtered under supervision	887
	Unaccounted for	2
b.	Number slaughtered under supervision	887
	Condemned as unfit for food	171—19.2%
	Passed for food	716—80.8%
	Showing "no visible lesions"	43— 4.8%

C. Expense Incurred

Salaries	$ 284.42
Subsistence	79.25
Telephone	8.10
Transportation at 8¢ per mile	167.28
Total of items	$ 539.05

Note: Cost of tuberculin, tags and equipment or supplies not included.

III. In Cameron Precinct, Hall County

Period—August 8 to September 17, 1927

A. Testing Completed

a. Number of flocks tested	81
Of same containing reactors	41—50.6%
b. Number of chickens tested	6,225
Of same hatched spring, 1926	3,503—56.3%
Of same hatched before 1926	2,722—43.7%
c. Number of chickens reactors	260— 4.1%
Of same hatched spring, 1926	102— 2.9%
Of same hatched before 1926	158— 5.8%

Note: Tuberculin-testing of cattle under area plan on the initial test revealed the incidence of tuberculosis among cattle in Cameron Precinct to be 1.8 per cent and the herd morbidity rate 14.9 per cent. The last test completed shows the incidence to have been reduced to 0.6 per cent and the herd morbidity to 6.2 per cent. The normal cattle population approximates 1700 herds, containing 22,000 cattle.

B. Disposition of Reactor Chickens

a. Number of reactors	260
Destroyed on premises	31
Slaughtered under supervision	222
Unaccounted for	7
b. Number slaughtered under supervision	222
Condemned as unfit for food	54—24.6%
Passed for food	168—75.4%
Showing "no visible lesions"	7— 3.1%

C. Expense Incurred

Salaries	$ 310.27
Subsistence	104.31
Telephone	2.96
Transportation at 8¢ per mile	200.36
Total of items	$ 617.90

Note: Cost of tuberculin, tags and equipment or supplies not included.

IV. In Lincoln Precinct, Johnson County

Period—October 10, 1927, to November 19, 1927

A. Testing Completed

a. Number of flocks tested	90
Of same containing reactors	69—76.6%
b. Number of chickens tested	17,748
Of same hatched spring, 1927	9,604—54.1%
Of same hatched before 1927	8,144—45.9%
c. Number of chickens reactors	1,696— 9.6%
Of same hatched spring, 1927	102— 1.1%
Of same hatched before 1927	1,594—19.5%

Note: Tuberculin-testing of cattle under area plan on the initial test revealed the incidence of tuberculosis among cattle in Lincoln Precinct to be 1.1 per cent and the herd morbidity rate 4 per cent. The normal cattle population approximates 100 herds, containing 1200 cattle.

B.	Disposition of Reactors		
	a. Number of reactors	1,696	
	Destroyed on premises	20	
	Slaughtered under supervision	1,612	
	Unaccounted for	64	
	b. Number slaughtered under supervision	1,612	
	Condemned as unfit for food	240	14.9%
	Passed for food	1,372	85.1%
	Showing "no visible lesions"	78	4.8%
C.	Expense Incurred		
	Salaries	$ 563.51	
	Subsistence	186.51	
	Telephone	3.90	
	Transportation at 8¢ per mile	171.36	
	Total of items	$ 925.28	

V. Summary of Testing of Chickens for Tuberculosis in Four Precincts of Three Different Counties of Nebraska during 1927

A.	Testing Completed		
	a. Number of flocks tested	291	
	Of same containing reactors	216	74.3%
	b. Number chickens tested	40,073	
	Of same one year and under	23,165	57.8%
	Of same over one year	16,908	42.2%
	c. Number of chickens reactors	3,760	9.3%
	Of same one year and under	843	3.6%
	Of same over one year	2,917	17.0%
B.	Disposition of Reactors		
	a. Number of reactors	3,760	
	Destroyed on premises	149	
	Slaughtered under supervision	3,515	
	Unaccounted for	96	
	b. Number slaughtered under supervision	3,515	
	Condemned as unfit for food	729	20.7%
	Passed for food	2,786	79.3%
	Showing "no visible lesions"	181	5.1%

The tuberculin-testing herein reported presents additional evidence to support certain previous observations which have been made, indicating a vast amount of avian tuberculosis existent in the poultry flocks located on the farms of the mid-western states. Although the testing reported covers but a comparatively limited area, and the findings of such testing cannot properly be applied as a common index of the extent and prevalence of avian tuberculosis even within Nebraska, the evidence thus supplied shows an urgent need for the inauguration of measures to suppress the infection of avian tuberculosis which apparently does occur in a very high percentage of the poultry flocks in the eastern half of Nebraska.

Observations made at the time these tests were being applied indicate the necessity of using tuberculin as a means for making an accurate determination of the presence of tuberculosis in

poultry flocks. It was found, in the course of testing and making postmortem inspections of reactors, that many flocks containing tuberculous chickens would no doubt have passed as free under a most scrutinizing physical inspection. Many reactor chickens were condemned on account of extensive or generalized tuberculosis, the carcasses of which birds were in excellent physical condition.

Incident to handling the chickens slaughtered under inspection, the marketing of the finished product was watched with particular concern. Some mention has been made with reference to establishment of postmortem inspection of poultry as applied to other classes of meat-producing animals, under the federal Meat Inspection Act. While the equipment and methods employed were without precedent and temporary in every particular, the experiences indicate that such an inspection would be economically possible. However, other features involving the marketing of the finished product appear to make such a plan impractical at this time. The slaughtering establishment handling the reactor chickens has not been successful in securing a profitable market. In fact, owing to the poor keeping quality of the dressed carcasses as handled, as well as meeting a skeptical buying public, there remains unsold a large part of the poultry thus prepared. With an average wholesome marketable percentage of eighty per cent of the slaughtered reactors, yet with a twenty per cent unfit for food purposes, the economical and proper disposal of known tuberculous poultry offers a problem for further consideration.

The cost of tuberculin-testing poultry flocks, as indicated by the work in Nebraska, might be viewed as prohibitive. Considering the individual flock or bird value, such would be a proper estimate, but with the production value as well as the investment value of the flock considered, testing would not be an economically unsound practice. On the Nebraska farms on January 1, 1927, conservative estimates place the poultry population at 13,517,000 head, with a value of approximately $12,000,00. During the twelve months immediately preceding January 1, 1927 (calendar year 1926), poultry and egg production, sold and consumed, amounted to a value of $31,992,000. With such values, and so great a spread between production and investment, Nebraska can well afford a considerable expenditure for supporting the essential service that becomes

necessary in combating so deadly a menace as tuberculosis has become to the poultry industry.

However, the Nebraska Department of Agriculture is of the opinion that further testing of poultry at this time, in Nebraska, will be of less value for the purpose of eradicating tuberculosis than certain other measures which may be adopted at much less cost. With a flock morbidity-rate as high as that indicated by this report, the locating of infected flocks serves of comparatively limited value with a view to applying quarantine measures for the suppression of the disease in such flocks. The great spread between the low incidence of tuberculosis among young birds and the high incidence among old birds prompts the Department to direct an effort to secure a change in the usual scheme of flock management. Such change would be to get flock-owners to dispose of old birds and not keep any poultry over two years in their flocks. Where tuberculosis is demonstrated in a flock, the owner will be directed to keep no birds in his flock over one year. It is reasonable to expect that if such a practice becomes established, the great mass of tuberculosis infection among poultry will be suppressed, and with such practices continued, with certain modifications to apply to known infected flocks, avian tuberculosis can be practically eliminated within the period of a few years.

In an effort to establish these practices in poultry husbandry, the Nebraska Bureau, in cooperation with the federal Bureau and the Extension Department of the State Agricultural College, has made tentative plans to hold a series of meetings in certain counties, particularly those counties in which testing of poultry was carried forward. Facts regarding avian tuberculosis, its relation to the live stock industry and the proposed methods for suppressing the disease will be explained by representatives of the state and federal bureaus, and methods of flock management, that may apply in a practical way in handling the flocks, will be outlined and discussed by representatives of the poultry extension department. We hope to make further report in another year as to the success of our endeavors under such a plan. We are not committing our position to eliminate the use of tuberculin as a useful instrument, but for the present would, as previously stated, limit its use in our work in eradicating tuberculosis among poultry in Nebraska.

REFERENCE

[1]Hays, C. H.: Avian tuberculosis eradication from the standpoint of public disease control. Proc. 30th Ann. Meet., U. S. Live Stock San. Asso. Jour. A. V. M. A., lxx (1927), n. s. 23 (6), p. 907.

DR. J. R. BEACH: In his paper this morning Dr. Rich made a statement with reference to hatcheries that were also selling cockerels and pullets, that they were feeding infertile eggs to the cockerels and pullets. I wonder if he attached any significance to that, with reference to the spread of avian tuberculosis.

DR. RICH: I put that in the nature of a question. I questioned it myself; I do not know. I hope somebody will find out. I was not aware until last year that they were feeding the raw eggs to the chickens. I had been advised the business of the hatchery was a day-old proposition. When we began investigations and made visits to the hatcheries, we found there was quite a percentage doing business in six- and eight-week-old pullets and cockerels, and that was increasing rapidly. They admitted those were the eggs from the better bred fowls, that the day-old chick was largely, you might say, eggs of mill run, gathered from any old fowls. They thought a large percentage of these chicks were going out to those that were in the broiler business. They said the losses were so great by the small poultryman he had stopped buying day-old chicks for replacement in his flocks, and was buying those that were six or eight weeks old.

To illustrate what I have in mind, or what was found: At one place visited they had several thousand chicks which they were keeping until they would be old enough to determine whether they were pullets or cockerels. They were dividing them into flocks of about 400, in order to be handled in a brooder. Those chickens being observed were probably about ten days or two weeks old. They were being fed five times a day, a mixture, as I remember, of oatmeal and ground oats and bran, and each feed contained one egg taken from the incubator, handing out infertile eggs taken from the incubator five to seven days. Those 400 were getting five eggs a day.

I have been boring many of my friends for two or three years by endeavoring to find out what was happening inside of the egg after being put in the incubator. I have asked this question repeatedly. I have insisted for a long time that the least damage that would come from an infected egg would be for that egg to hatch, and you would have only one infected chicken. I have wondered, and wonder now, what happens in the incubator. In our case, where we have commercial hatcheries, located in an area where at least 50 per cent of the flocks are infected, and their eggs are coming from those flocks, I believe we are told there is a very small percentage of infected eggs as laid, but I have a feeling there are quite a good many eggs that are infected externally. Do they not infect the premises to which they are taken? What happens to those bugs in the eggs? We will take the infected egg first. Do they lie dormant? Do they die, or do they multiply? The same with the bugs on the outside of the egg. I get all kinds of answers, but I have not heard from anyone who can tell me exactly what is happening.

Dr. Ravenel spoke the most positively in regard to that. I asked him this question, and he said he had never done any experiments along that line, but he felt positive, from the work he had done in growing tubercle bacilli, that the avian germ within the egg would be in a most natural medium, and putting that into an incubator with a temperature of 103° would be the most natural place for multiplication. He said he felt sure he would find it that way, that they would multiply quite rapidly. He had a feeling that perhaps the germs on the outside of the egg would die because of it being so dry, although he admitted he had no experience with a chicken incubator, and did not realize there was considerable moisture in most of those.

I have only to put that as a question. I am in hopes that some one will tell us whether there is any danger there. I have a feeling it is quite possible that our infection is being spread in that way, and, instead of one egg hatching and producing an infected chicken, we may be sending out several hundred or several thousand that have gotten it through their feed.

DR. C. P. FITCH: We completed, last spring, our work on the transmission of avian tuberculosis through the eggs of tuberculous fowls. In carrying on this work we completed some experiments which will answer the question Dr. Rich raised at this time.

We found, as the result of the examination of over 800 eggs from over 60 tuberculous birds, that less than 1 per cent of the eggs from these birds contained avian tubercle bacilli, and, strange to say, the extent of the disease in the bird, or the location of the disease in the bird, did not determine the presence of the germ in the egg.

We also washed the eggs, that is the shells, from tuberculous birds, and injected the centrifuge washings into susceptible poultry, and, much to our surprise, failed to produce tuberculosis. Apparently the shell is not an active source of the spread of the disease.

The second year we carried the experiments further in the incubation and hatching of the eggs from tuberculous fowls. We incubated over 2,000 eggs and hatched over 600 chicks, and in not a single instance of all the chicks, some of which died young and were carefully autopsied, and those which reached maturity, were tuberculin-tested and then autopsied, did we find the ence of tuberculosis.

Further, we inoculated eggs with the avian tubercle germ, and there is not the slightest particle of doubt that that germ does multiply in the egg, and the chicks hatched from such artificially infected eggs were in every instance tuberculous, dying, in most instances, early in life, but those which reached maturity showed generalized tuberculosis. Thank you. (Applause)

DR. H. R. SCHWARZE: I would like to ask Dr. Fitch whether they examined the eggs that were infertile.

DR. FITCH: We did, and found large numbers of them.

DR. RICH: I would like to ask Dr. Fitch if there would not be some danger in feeding the eggs raw?

DR. FITCH: There is no question about that.

DR. RICH: That is the point I am interested in. I desire to thank you for this information. I have been trying for the last three years to get as direct an answer as you have given me today.

PRESIDENT VAN ES: Is there any further discussion? If not, the program of the day has been concluded, and a motion that we adjourn is in order.

. . . A motion for adjournment was regularly made, seconded and carried. The meeting adjourned at 4:50 p. m. . . .

FRIDAY MORNING, DECEMBER 2, 1927

The fifth session convened at 9:30 a. m., President Van Es presiding.

PRESIDENT VAN ES: The first number is a paper on "The Relation of the Agglutination Test to the Presence of *Brucella Abortus* in the Body of the Bovine." Dr. Huddleson not being here, Dr. Ward Giltner will present it. (Applause)

. . Dr. Giltner read the paper. . . .

THE RELATION OF THE AGGLUTINATION TEST TO THE PRESENCE OF BRUCELLA ABORTUS IN THE BODY OF THE BOVINE

By I. FOREST HUDDLESON, J. P. TORREY *and* E. R. CARLSON,

Michigan State College, East Lansing, Mich.

There was presented before this Association last year an excellent discussion by Dr. Fitch[1] on the value and need of uniform methods in conducting tests for the diagnosis of Bang's abortion disease in cattle. It was pointed out that there existed a lack of uniformity in methods and consequently a disagreement in re-

sults. It was further demonstrated that such discrepancies could easily be remedied through cooperative efforts.

It is not the purpose of this paper to dwell on the accuracy of the serological tests, but to present some aspects of the agglutination test as regards its significance in interpreting the presence of *Brucella abortus* in the body of the animal.

Considerable information may be obtained on the subject by studying the serum agglutination reaction of animals in a large, naturally infected herd, at thirty-day intervals for a period of one or more years, in conjunction with the breeding record of each animal and periodical bacteriological examinations of material in which the pathogen is commonly found, that is, the fetus, fetal membranes and the milk. The agglutination test, conducted at the interval mentioned, should reveal the reaction curve in recently infected animals and in those of long standing. It also should show possible fluctuation and decline in the curve and their significance in terms of the presence of the parasite in the body.

From such a study one begins to learn the real nature and significance of a disease in the bovine due to *Br. abortus*, not necessarily in terms of a single symptom which is commonly spoken of as expressing the presence of the disease and which is often absent, namely, the premature expulsion of the fetus. It is common to encounter in an infected herd many infected animals which never abort and seldom show the presence of the parasite in the fetal membranes. These cases are difficult to explain to the average breeder as having any significance, due to the fact that more stress has been laid on the occurrence of the expulsion of the fetus than on the diseased condition of the animal. When more data are compiled, of the nature of that presented by White and associates,[2] namely, milk-production of infected animals, a positive serum reaction on an apparently normal animal will be appreciated. More studies of this nature may reveal that the diseased udder is of just as great an economic importance as the premature expulsion of the fetus.

In a large herd where the disease exists, one expects to find animals resistant to an invasion of the parasite and failing despite exposure, to show even serum-agglutinins to any degree over a long period of time. They will be few in number. One also will encounter resistant animals which occasionally, and for a short time only, show serum-agglutinins to a slight degree. There are encountered animals whose tissues are invaded by the

parasite to a sufficient degree to bring forth serum-agglutinins to a high degree, but the parasite fails to remain long enough even to be detected by bacteriological examinations. There are cases in which the invasion is sufficiently extensive to result in the expulsion of the fetus, or to produce changes in the fetal membranes or udder. Many of these cases remain permanently infected, but a few, after a period of time which varies with the individual animal, become free of the disease. The serum-agglutinins in the latter cases present a declining titer-curve when studied at intervals for a long period of time.

The presentation of evidence obtained in a large, naturally infected herd, not affected by control measures that involve the relationship between serum-agglutinins and the presence of the parasite in the host, is of special significance at this time in view of the well-directed efforts to control the abortion disease by various means, such as segregation, slaughter, and control over the movements of animals from one location to another. The first question to consider in this relationship is the time interval between exposure and the occurrence of actual infection as determined by means of blood tests which are at present our only practical means of determining infection. It is common knowledge that this point is difficult to determine from observations made in naturally infected herds, since the actual time of exposure always remains a question. Considerable information, however, may be obtained from well-controlled experiments in which animals are subjected to the natural mode of exposure, that is, by way of the mouth. There are already available much valuable data on this subject, notably the experiments performed by Buck and Creech,[3] in which the animals were exposed to infective material once and placed in isolation, and those of Birch and Gilman,[4] in which the animals were exposed to infective material three times weekly for varying periods of time. The first-mentioned investigators found a very wide variation in the time of the appearance of serum-agglutinins in individual animals after exposure, the interval varying from one month to five months. In cases where abortion followed exposure and subsequent infection, the time interval between exposure and abortion in individual animals varied from one and one-half to six months, or from zero days to six months after the first appearance of agglutinins in the blood.

In the experiments of Birch and Gilman there appears to be quite a different situation in respect to the time interval between

exposure and the first appearance of agglutinins. Here the time interval varied from fifteen days to one month. In those cases involving the premature expulsion of the fetus, the time interval was also much less, varying from one to four months after exposure or fifteen days to three months after the first appearance of agglutinins in the blood. These investigators have established conditions and presented the results therefrom similar to what one might expect to encounter in any infected herd or in animals coming from an infected herd. In all of their cases the agglutination test has served as a delicate indicator of the state of the disease, excepting those in which the disease manifested itself before, or a very short time after, the appearance of agglutinins. This is a situation which one occasionally encounters in routine testing or in following the course of the disease in a herd by conducting tests at short intervals. We have encountered five cases in one large herd during a two-year period. The animals did not react to the agglutination test until the day of, or a few days before, aborting. The test was conducted at thirty-day intervals. The serum agglutination reaction of three of the animals is presented in table I as numbers 4, 8 and 9, and one in table II as number 17. The five cases represent approximately fifteen per cent of a total of thirty-two animals which became reactors in the herd during this period. This particular discrepancy between the agglutination test and the state of the disease, while not a serious one, is probably the most important one aside from laboratory technic which has been encountered. The cause for the failure of animals to develop agglutinins in their blood, until the time the chief symptoms arise, has not been shown, despite many hypothetical explanations now on record. It is possible that the discrepancy may be eliminated in time, or we may be forced to accept it as a limitation of the test, as has been the case in other serological or allergic tests applied in the diagnosis of other diseases of animals and man.

There is another group of animals, the serological tests of which we have considered. They are those in which the parasite fails to establish itself permanently. The pathogen may fail to establish itself altogether or it may do so for a short time, producing sufficiently extensive changes in the pregnant uterus to result in premature expulsion of the fetus, or anatomical changes in the fetal membrane at parturition and in the udder.

The serum agglutination reaction of a number of animals falling in this group in one large infected herd which we have

had occasion to observe for a long period of time is presented in tables II and III. The evidence of the presence or absence of *Brucella abortus* has been obtained from repeated bacteriological examinations of material in which it is commonly found. If the serum agglutination curve is plotted over a considerable period of time, one may readily see that the agglutination test has been an accurate indicator of the presence of *Brucella abortus*, and also of its absence; or of the time it leaves the body. In this particular herd, during the past two years, a total of thirty-two animals developed a sufficiently high agglutination titer to be classified as infected and it is possible that all were infected for a period of time, but of this number twelve became free from the disease, as indicated by a slowly declining agglutination titer recorded monthly. The absence or disappearance of *Br. abortus* from the bodies of these animals was further confirmed by repeated bacteriological examinations of material suitable for bacteriological tests.

The differentiation of animals falling into this group, from those actively infected, is of vast importance, because there is accumulating evidence which points to the fact that they acquire, for some time, a high and fairly stable degree of resistance to a future invasion of the parasite. That is to say, they possess an active acquired immunity. It may be said further, that they have become a very valuable type of animal in respect to the control of the disease. That is, they may be placed with infected animals or placed in herds free from Bang's abortion disease without the danger of their becoming infected or transmitting the disease. They should not by any means be slaughtered as long as they are profitable animals, for they are an important link in the chain of efforts being made to suppress the disease.

After having established the fact that there are many animals in infected herds belonging to the group just discussed, viz., those having an active acquired immunity, there still remains the question of devising a practical method for detecting them. It is obvious that the methods we now use are inadequate except on a limited scale. Aside from our present methods, some effort has already been made to differentiate infected animals that react to the agglutination test from those that are not infected, by means of the intracutaneous or intradermal test. The studies thus far have been confined largely to the guinea pig. The most notable work in this connection is that of Fleischner and Meyer[6] and of Stafseth.[7] Their data very

clearly demonstrated that infected pigs would react to the skin test, while pigs injected with killed cultures failed to do so. When applied to the cow under natural conditions, a different situation exists. The development of the state of allergy, in an animal responsible for the reaction, appears to depend upon an invasion of the tissues by the living virus; and, since the living virus is directly responsible for the appearance of agglutinins in a cow free from the disease, one would expect to find a state of allergy existing, that is, a response to the skin test.

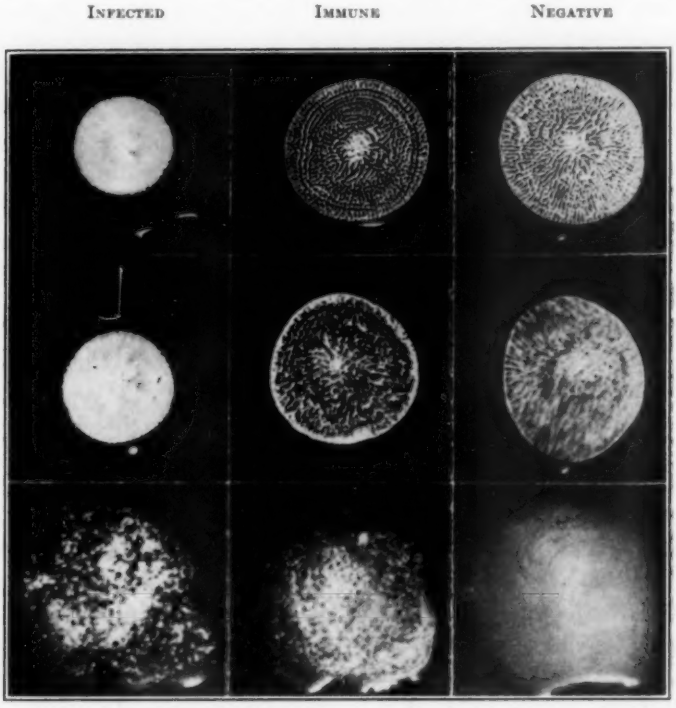

FIG. 1. Upper row—reaction after fifteen-second period. Middle row—reaction after two-minute period. Lower row—after mixing.

And that is exactly what has been found to be the case. Therefore, insofar as the skin test is concerned, no differentiation is obtainable.

Weil and Felix demonstrated that there is a difference in the macroscopic, test-tube, agglutination reactions with typhus-infected and typhus-immune sera. Later Felix[7] showed that typhoid-immune serum gives a different type of macroscopic agglutination reaction from that with infected serum.

Recently, while studying different antigens in their application to the rapid macroscopic agglutination test for detecting the abortion disease in cattle, we were surprised to find, in using one of the antigens, that a different type of reaction was manifested by serum from known-infected animals than from those not infected, even though agglutinins were present in many cases in a high titer.

The difference in the two types of reaction may be demonstrated by placing one drop of antigen from a graduated dropper-pipette on 0.1 cc of serum on a glass plate and not disturbing the reagents while the reaction is in progress. The difference so far has been constant, that is, weekly and monthly tests reveal the same type of reaction as long as the animal is actively infected. It is difficult to describe the two types of reactions or even to learn much from a photograph of them since they are progressive up to a certain period. It is necessary to see the reactions in order to understand their full significance.

In the case of a serum from an infected animal, the drop of antigen spreads out as a flat, circular, compact mass, with little further change. Whereas, in the case of a serum from a non-infected animal in which agglutinins are present, the antigen first spreads out into a flat, circular mass; but in about 10 seconds there is seen to develop interspaced, irregular, white, granular lines radiating outward from the center and broken with one or more irregular, interspaced circles of the same nature. This type of formation continues to change slowly, the lines becoming more irregular and the clear interspaces becoming more distinct or larger until a period of two minutes has passed, after which there is little change in the formation. When the formation of antigen in either of the two types of reaction just described is broken up with a toothpick, it will be seen that it is in a state of irregular clumps or agglomerations.

In the case of a serum free from agglutinins, in other words, a negative serum, a type of reaction ensues very similar to that obtained with the former one just described. The white granular lines are not so irregular and instead of becoming more fixed, they tend to undergo dissolution until only a faint trace of a line is left. The clear interspaces become cloudy and the area presents a hazy or foggy appearance. After a lapse of about two minutes, the area over which the antigen has spread itself has become distinctly cloudy. When it is broken up with a tooth-

TABLE I—*Agglutination reactions of cows 1 to 12, over a period of nineteen months. (Compare with breeding data and bacteriological findings appended to paper.)*

DATE OF TEST	1926										1927								
	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
COW	SERUM AGGLUTINATION TITER*																		
1	—	—	—	500	500	500	500	500	500	500	200	200	100						
2	—	—	—	—	—	500	500	500	500	500	500	500	500	500	500	500	500	500	500
3	—	—	—	100	500	500	500	500	500	500	500	500	500	500	200	100	100	100	500
4	—	—	—	—	—	—	—	—	—	—	25	500	500	500	500	500	500	500	500
5	—	—	—	—	—	—	—	—	p25	200	500	500	500	500	500	500	500	500	500
6	25	p25	100	50	25	p25	200	100	100	200	100	200	100	500	100	100	200	500	500
7	—	—	—	50	200	500	500	500	500	500	500	500	500	500	500	500	500	500	500
8	—	—	—	—	—	p25	—	—	—	—	—	—	—	—	—	—	—	500	500
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	500	500
10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	100	500	200	200	500
11	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
12	25	25	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500

*An agglutination titer of 1-25 is expressed as 25 in these tables. 500 means 1-500, etc. p = partial.

TABLE II—*Agglutination reactions of cows 13 to 21, over a period of nineteen months. (Compare with breeding data and bacteriological findings appended to paper.)*

DATE OF TEST	1926										1927								
	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
COW	SERUM AGGLUTINATION TITER																		
13	500	200	200	500	25	500	500	100	200	100	200	50	—	100	25	25	25	25	25
14	—	—	—	—	—	—	—	—	500	500	500	500	100	500	50	100	50	100	50
15	—	—	—	—	25	200	500	500	200	200	100	50	50	50	50	25	25	25	25
16	—	—	100	100	500	500	500	50	200	100	100	100	50	100	50	50	25	50	25
17	—	—	—	—	—	—	—	—	—	50	—	200	500	500	200	100	25	25	25
18				—	—	—	—	100	500	50	25	—	50	p25	p25	p25	p25	p25	p25
19						—	p25	p25	200	200	100	100	200	200	200	100	25	100	100
20	—	—	—	—	—	—	—	—	—	100	100	100	—	200	500	50	50	50	50
21	50	50	50	50	100	50	100	50	100	100	100	100	50	25	100	100	100	50	50

TABLE III—*Agglutination reactions of cows 22 to 29, over a period of nineteen months. (Compare with breeding data and bacteriological findings appended to paper.)*

Date of Test	1926										1927								
	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Cow	Serum Agglutination Titer																		
22	—	—	—	—	25	50	—	p25	p25	—	p25	—	—	25	25	25	25	25	25
23	—	—	—	—	p25	p25	25	25	25	p25	25	25	p25	50	p25	25	25	50	25
24	50	50	50	50	50	50	50	25	50	50	50	25	50	50	50	50	100	p25	50
25	50	100	200	100	50	50	25	25	p25	50	50	25	p25	25	25	—	—	25	25
26	—	—	—	—	—	—	—	25	50	100	50	25	p25	—	p25	25	25	—	25
27	—	—	—	—	—	—	—	—	—	100	50	p25	p25	25	p25	p25	p25	p25	p25
28				50	100	200	100	100	100	p25	p25	p25	—	25	p25	—	p25	p25	—
29								—	—	—	—	200	100	50	25	25	25	p25	p25

pick, it will be seen that the antigen is not clumped but is still in a finely divided state of suspension.

Since this type of a differential reaction is of recent development and has been applied only to a limited number of sera, it is not possible to say at this time what further study will bring forth. But so far, in its application to sera from known-infected cows, infected guinea pigs, and humans affected with undulant fever, it has confirmed the presence of the disease and its absence, as determined by bacteriological methods.

BREEDING DATA AND BACTERIOLOGICAL FINDINGS PERTAINING TO ANIMALS RECORDED IN TABLES I, II AND III

Animal 1: Jersey Born, 6-15-23. Aborted 7-months fetus, 6-12-26. *Br. abortus* recovered from fetus, fetal membrane and milk. This case is of interest in that the first evidence of specific agglutinins was obtained just twelve days before the expulsion of the fetus occurred and the parasite disappeared from the udder shortly afterwards.

Animal 2: Holstein. Born, 12-19-22. First parturition, 5-5-26, normal; aborted an eight-months fetus, 6-18-27; now sterile. The blood of the animal began to react to the agglutination test in a high titer three months after the first parturition. *Br. abortus* was cultured from the milk for the first time, October, 1926, and many times since. *Br. abortus* was isolated from the fetus and fetal membranes, 6-18-27.

Animal 3: Jersey. Born, 12-22-22. First calf, 2-12-26; parturition normal; failed to conceive until 7-9-27. The agglutination test showed evidence of infection four months after first parturition. *Br. abortus* was found in the milk of all quarters, 10-15-26, and until February, 1927, when lactation ceased.

Animal 4: Holstein. Born, 8-2-24. Aborted a six-months fetus, 1-30-27. Has failed to conceive since. *Br. abortus* recovered from fetus, fetal membranes and milk. The milk continues to show the organism in all quarters. There was no evidence of agglutinins in the blood-serum until the day the abortion occurred.

Animal 5: Holstein. Born, 8-14-24. Aborted a six-months fetus, 3-12-27. *Br. abortus* recovered from fetus, fetal membranes and milk. The milk showed the organism, 12-15-26, or approximately three months before the abortion occurred and still continues to do so.

Animal 6: Jersey. Born, 8-24-24. Aborted an eight-and-one-half months fetus, 9-21-27. *Br. abortus* recovered from fetus, fetal membranes and milk. The milk continues to show the organism.

Animal 7: Guernsey. Born, 9-5-24. Aborted an eight-months fetus, 9-15-26; aborted a five-months fetus, 4-23-27. *Br. abortus* was recovered from both fetuses and membranes and milk since first abortion. The animal failed to conceive after the second abortion and was slaughtered, 10-5-27. The os uteri was found sealed and *Br. abortus* was recovered from the uterus in pure culture, approximately five and one-half months after the abortion occurred.

Animal 8: Holstein. Born, 6-18-24. First calf, 10-26-26; parturition normal; aborted a seven-months fetus, 8-10-27. *Br. abortus* was recovered from the fetus, membranes and milk. There was no evidence of agglutinins in the blood-serum until ten days before the expulsion of the fetus.

Animal 9: Jersey. Born, 10-14-24. First parturition, 11-23-26, normal; fetal membranes normal; aborted an eight-months fetus, 8-11-27. *Br. abortus* recovered from the fetus, fetal membranes and milk. The blood of the animal was negative to the agglutination test until eleven days before the abortion occurred.

Animal 10: Jersey. Born, 4-12-25. Aborted a six-months fetus, 10-5-27. *Br. abortus* recovered from fetus, membranes and milk. There was evidence of infection from the agglutination reaction five months before the expulsion of the fetus.

Animal 11: Holstein. Born, 10-13-22. Aborted a six-months fetus, 7-20-24. *Br. abortus* recovered from fetus, membranes and milk. The milk has continued to show the organisms. Parturition, 10-7-25, normal; one small patch of villi on one placental area necrotic. *Br. abortus* obtained therefrom. Parturition, 11-17-26, normal. Fetal membranes normal in appearance, but *Br. abortus* was recovered from a placental area. Agglutinins appeared in the blood serum for the first time, 5-7-24, and have been present in a high titer ever since.

Animal 12: Holstein. Born, 4-6-23. First parturition, 3-27-25, normal. Second, 4-16-26, normal; fetal membranes normal. *Br. abortus* recovered from milk at this time and constantly present since. Third parturition, 4-21-27, normal. There were two partially necrotic placental areas on the membranes. *Br. abortus* not recovered. The blood began to show agglutinins, 1-14-26.

Animal 13: Jersey. Born 2-2-22. Aborted a six-and-one-half-months fetus, 3-24-24. No bacteriological examination made. Parturition, 3-24-25, normal. No bacteriological examination made. Parturition, 3-28-26, normal. *Br. abortus* not recovered from fetal membranes. Recovered from milk, 1-15-26, and date of parturition. Parturition, 2-8-27, normal. *Br. abortus* not recovered from fetal membranes or milk and has not been recovered from milk up to October, 1927.

Animal 14: Holstein. Born, 9-21-22. Parturition, 9-7-25, normal. No bacteriological examination made. Parturition, 11-19-26. *Br. abortus* was not recovered from the fetal membranes or milk. Many examinations of milk since have failed to show the organism.

Animal 15: Holstein. Born, 12-18-23. Parturition, 6-14-26. *Br. abortus* not recovered from fetal membranes or milk. Parturition, 7-17-27, normal. *Br. abortus* again was not recovered from fetal membranes or milk. Many examinations of the milk have failed to show the presence of the organism.

Animal 16: Holstein. Born, 3-7-24. Aborted a seven-months fetus, 6-11-26. *Br. abortus* recovered from fetus. The milk has never shown the presence of the organism on repeated examination. Parturition, 7-12-27, normal. *Br. abortus* not recovered from fetal membranes or milk.

Animal 17: Jersey. Born, 11-25-24. Aborted a five-months fetus, 1-27-27. *Br. abortus* recovered from fetus, fetal membranes and milk. The milk has since failed to show the organism.

Animal 18: Holstein. Born, 8-1-25. Bred, 6-11-27.

Animal 19: Guernsey. Born (?). First parturition, 5-24-26, normal; second parturition, 10-2-27, normal; no changes in placental or intraplacental areas of membranes. *Br. abortus* not recovered from fetal membranes or from the milk.

Animal 20: Holstein. Born, 2-24-25. Bred, 4-17-27.

Animal 21: Holstein. Born, 10-27-26. First parturition, 12-20-18, normal; aborted a seven-months fetus, 10-24-19; no examination made for *Br. abortus;* parturition, 1-2-21, normal; parturition, 4-15-23, normal; parturition, 7-22-24, normal; parturition, 10-10-25, calf blind; parturition, 10-17-26, normal; fetal membranes showed two partially necrotic placental areas; *Br. abortus* not found. *Br. abortus* has not been recovered from the milk on repeated examination since November, 1926.

Animal 22: Holstein. Born, 10-18-19. Aborted a nine-months fetus, 10-1-21; parturition, 8-25-22, normal; parturition, 12-11-23, normal; calf died of pneumonia, 12-23-23; parturition, 4-30-25, normal; parturition, 5-4-26, normal; parturition, 8-25-27, normal; placental areas examined for *Br. abortus,* negative. *Br. abortus* has never been found in the milk.

Animal 23: Holstein. Born, 12-5-19. First parturition, 10-7-21, normal; parturition, 2-25-23, normal; parturition, 7-4-24. normal; parturition, 3-16-27, normal. Calf died of pneumonia, 3-20-27. *Br. abortus* has never been found in the milk.

Animal 24: Jersey. Born, 3-15-20. First parturition, 6-26-22, normal; parturition, 10-7-23, normal; aborted an eight-and-one-half-months fetus, 9-15-24. No examinations made for *Br. abortus;* parturition, 8-22-25, normal; parturition, 6-28-26, normal; fetal membranes negative for *Br. abortus;* parturition, 9-26-27, normal; fetal membranes negative for *Br. abortus.* The

organism has not been recovered from the milk on repeated examination since November, 1926.

Animal 25: Jersey. Born 7-16-23. First parturition, 9-18-25, normal; parturition, 12-23-26. *Br. abortus* not recovered from membranes. Examinations of the milk since March, 1926, have failed to reveal the parsite present.

Animal 26: Holstein. Born, 5-16-25; not bred.
Animal 27: Holstein. Born, 5-18-25; bred, 7-15-27.
Animal 28: Holstein. Born, 8-17-25; bred, 5-17-27.
Animal 29 Holstein. Born, 1-13-26; not bred.

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PRESIDENT VAN ES: We will proceed to the next paper, "Progress of Bang Bacillus Disease Control in Pennsylvania," by Drs. M. F. Barnes and H. R. Church. (Applause)

. . . . Dr. Church read the paper. . . . .

PROGRESS OF BANG BACILLUS DISEASE CONTROL IN PENNSYLVANIA

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SUMMARY OF EARLY DEVELOPMENTS

In the 1895 report of the Pennsylvania Department of Agriculture, it was shown that Dr. R. S. Huidekoper classified abortions of cattle into two groups, sporadic and contagious. He considered the contagious, or transmissible, form the more prevalent. In either case as a control measure it was recommended that aborted fetuses be burned or buried. It was thought that cows could be moved away from the infection by moving them to clean premises. Tar balls or tar water and hypersulphate of soda were recommended in the treatment of pregnant animals.

In the 1896 report, Pearson recommended thorough disinfection of stables and the genital organs of the cow. One per cent creolin was introduced into the vagina two or three times a

week for three or four months. Weak solutions of carbolic acid were injected subcutaneously.

In the 1897 report, the same principles were recommended and, in addition, clipping of the hair surrounding the prepuce of the bull and disinfection of the sheath, both before and after service. In 1902, these principles were more extensively outlined in the form of a definite plan. During the succeeding several years subcutaneous injections of carbolic acid were quite extensively practiced, the Pennsylvania Bureau continued to recommend sanitation and disinfection, and it was believed that transmissible abortions were becoming less prevalent.

In 1911, Meyer isolated several strains of the Bang bacillus and made preparations for installing the complement-fixation and agglutination tests which, during 1912 and subsequently, were used as diagnostic tests.

During 1912, "abortin" was prepared and used under the direction of Meyer. The results obtained by Meyer and Hardenbergh[1] in its use were compared with the results of the complement-fixation and agglutination tests.

The authors concluded that, on over 200 animals tested with abortin, the product permitted a conclusive diagnosis in only 59 per cent of the cases of infection, compared with the serum reactions, and that only 71 per cent of the abortion reactions were supported by positive serum reactions. When purified abortin was used, the reactions were typical but not specific. The results were better in recently infected herds.

In a paper by one of the same authors, presented to the Keystone Veterinary Medical Association, it was shown that abortions occurred from diseases of the mother as well as from diseases of the uterus, e. g., aphthous fever, hog cholera, etc. The author stated:

> Under the term infectious abortion we include those abortions which occur in otherwise healthy mothers as a result of external infection producing inflammatory lesions of the uterine and fetal membranes.

This point is quoted to show that this author considered, as did many others, the "symptom" only.

In the 1912 report by Meyer, with reference to immunizing agents, it was contended that the abortions were less harmful that the retention of the afterbirth and the risk that the animal remain sterile. He stated:

> Bacterins undoubtedly cause, for anatomical reasons, such conditions and we take the opportunity of warning farmers against their use. The serum treatment will never be of any practical value, as the immunity is of only short duration.

He credited living cultures with producing some immunity, in that heifers so treated did not manifest the "symptom" after a virulent feeding infection. This does not indicate they were immune to the disease. He pointed out that if used on infected premises only, virulent cultures would not present any danger to other animals, and stated:

> As long as we do not know the effect of this organism on the health of human beings, we are not justified in recommending the use of living bacteria.

In 1913 and 1914, the Pennsylvania Bureau conducted quite an extensive experiment with the medicated methylene-blue treatment and concluded that it, with the carbolic acid treatment, was of no value. The Bureau continued to recommend the plan of 1902. It did not doubt that the disease could be controlled if the plan was faithfully and carefully followed along with local antiseptic treatment.

Throughout these annual reports, breeders were warned against the expenditure of money for the widely heralded, secret "abortion cures."

In 1916, rather extensive and systematic demonstrations of the Albrechtsen uterine-douche treatment were begun. It was thought at first that by this method the disease could be eliminated, but after these treatments had been systematically carried out in a number of herds over sufficient periods to demonstrate their worth, it was found that abortions still occurred and the breeding efficiency of treated herds was not noticeably increased.

All systems tried had failed to accomplish the desired end. None of them cured diseased animals and none eliminated the disease from the herds, yet possibly some of them lessened the spread of the disease to a slight extent. It is doubtful if any were productive of increased herd efficiency and it is certain that none of them decreased the cost of production.

The diagnostic tests and the systems of treatment were aimed at the wrong thing to bring about effectual control of the disease. The serum tests did not indicate whether an animal had aborted or would in the future. Some negative animals aborted later and some were negative that had previously aborted. The tests were practically discarded because they would not accurately determine the occurrence of this symptom, yet they seldom failed, when applied at a proper time, to diagnose accurately the specific transmissible disease. The abortin test, made with purified abortin, may yet be shown to be quite significant.

Summary of Developments Since 1919

Early in 1920, studies were started to obtain information pertaining to Bang bacillus disease which would enable our Bureau representatives to give sound advice to breeders and dairymen. Many breeders were discouraged and were willing to try most anything.

During the same year, vaccination experiments were begun and vaccinations with living cultures of the Bang bacillus were carried out officially in ten different infected herds, situated in different sections of the State. It was aimed in these experiments to meet the practical field conditions under which the veterinarian would use commercial vaccines. The summary of results[2] which showed 26.7 per cent abortions in 187 vaccinated animals, as against 24.5 per cent abortions in 143 controls, did not justify our Bureau in advocating the use of vaccines.

By the time results of vaccination were beginning to appear, the foundation principles of what is now known as the "Pennsylvania Plan for Prevention, Repression and Eradication of Bang Bacillus Disease" had been carried out in a few herds over periods of time sufficient to indicate the soundness of these principles when properly executed.

The first herd in which these principles were carried out dates back to 1912, at which time its owner, Col. Robert L. Montgomery, imported twelve females about two years of age. Mr. Montgomery aimed to start his herd on a healthy basis, and upon application of the tuberculin test one animal reacted suspiciously. The abortion blood test also was applied to the herd, with the result that one animal reacted to it. These two animals were removed from the herd and later one of the remaining animals died which left only nine of the original females as a herd foundation and, with the exception of a bull occasionally, no animals have ever been added to the herd. In previous publications this herd has been referred to as the First Herd. While it had been practically free from abortion ever since 1912, systematically repeated blood tests were not carried out in it until 1920. A reactor was removed on the first of these tests. The herd had averaged a calf per year for each mature female since 1912, which indicated that it was practically free from the disease. This history, combined with the fact that all animals, with the one exception, remained negative to several repeated blood tests, indicated that the test was accurate on healthy

animals. This we thought was sufficient justification for applying the test repeatedly to Bang bacillus-infected herds and removing reactors to determine if it was accurate in detecting all diseased animals.

The results obtained through repeated application of the blood test, removal of reactors and the practice of sanitary principles in infected herds up until December, 1921, justified the Pennsylvania Bureau in issuing a certificate at the time of a regular test on December 16, 1921, to the First Herd. This herd has held certificate No. 1 ever since that time.

The principles which had been systematically carried out in these few herds were formulated into the Pennsylvania Plan which was first published in the 1922 proceedings of this Association.[3]

The Plan has been the chief policy of the Pennsylvania Bureau for handling Bang bacillus disease ever since its adoption and has been voluntary on the part of breeders. Breeders who seek advice on the disease are made acquainted with the Plan and offered the Bureau's cooperation in carrying it out, if they see fit to adopt it.

The Plan is a method of "actual control" which requires determination and elimination of disease and diseased animals and the practice of methods necessary for safeguarding the herd. We believe that the execution of its principles constitutes the only successful method of control and elimination of this disease which has been produced up to the present time. It requires keeping of the cause and susceptible animals apart. It has been successfully carried out during the last seven years and its feasibility need no longer be doubted. No other method has been devised which eliminates Bang bacillus disease from the herd.

The Plan is carried out cooperatively by the herd-owner, his veterinarian and the Pennsylvania Bureau of Animal Industry. The Bureau insists that the veterinarian cooperate in this work at the owner's expense, for the reason that the veterinarian is qualified or can qualify more readily than any person who does not have veterinary training.

The number of herds operating under the Plan has been gradually increasing ever since its beginning. At the first of the year 1922, tests were being carried out systematically in about one-half dozen herds and one certificate had been issued. The report one year ago, at this meeting, showed that testing

was being done in 450 herds, 150 of which were signed up under the Plan and eight herds had been issued "abortion free" certificates. At the present time testing is being done in approximately 800 herds, 250 of which are signed up under the Plan and 49 have been issued certificates. The 49 abortion-free herds average thirty-four cattle per herd.

Some breeders who seemed the most enthusiastic in the beginning have not yet arrived at the point of carrying out the Plan in their own herds, while some of those who were the worst objectors are operating under the Plan or have made application for it. All those having abortion-free herds seem rather enthusiastic.

To illustrate further the growth of this work, it is estimated that during the year 1927, approximately 25,000 bovine sera from all sources will have been tested for Bang bacillus disease, as compared with 19,000 in 1926, 13,000 in 1925, 7000 in 1924, 4000 in 1923, 2500 in 1922, 2000 in 1921, 700 in 1920, and 100 in 1919.

In the early part of our work the question of the disposal of reactors was of considerable concern to our Bureau representatives. The Plan required that positive reactors must be disposed of in a manner satisfactory to the Bureau, yet, until September 10, 1926, the disease had not been proclaimed transmissible by the Pennsylvania Bureau. Positive animals were usually handled in a satisfactory manner, but the breeder's own conscience was usually the guiding factor regulating their disposal. Pennsylvania Bureau Regulation 523, defining Bang bacillus disease-infected animals and the manner in which they may be disposed of, became effective February 15, 1927. A copy of this regulation and the Pennsylvania Plan in leaflet form may be obtained by any person who makes application for them.

The best time to begin testing and the frequency of tests are dependent somewhat on existing conditions. If testing is begun during an active outbreak, the more frequently tests are applied and reactors removed the better will be the results. We usually recommend the application of tests every two months until all animals have been negative for a period of at least one year. In some instances, however, when dealing with an active outbreak, blood samples have been collected from the mature females and tested every two weeks until the outbreak became less active. It should be remembered that some animals do not react their first time until after having calved or aborted.

In constantly infected herds the disease is less active some years than others and there are years when very few or no abortions occur. During one of these quiescent years is an ideal time to begin testing in a herd. To demonstrate, a herd of 90 cows was tested in 1925 and there were 25 reactors which were not separated. A year later, in 1926, there was only one additional reactor and two of the previous reactors were negative. The reactors were not separated and in 1927 over fifty animals reacted and a number of abortions have occurred. The owner at this time has separated the negative animals. Had he made the separation at the time of the 1925 test, the disease would undoubtedly have been eradicated after one or two tests. A number of similar herds have been practically rendered free from the disease on a single test.

In badly infected herds having free contact between animals of all classes, reactors are found among mature cows, virgin heifers, calves and bulls. Animals of all ages both male and female become affected. The percentage of reacting young animals is lower than that of mature animals. Where young animals are kept separate from the mature herd, the percentage of reactors in this class is very low. These observations confirm those previously reported. [4,5,6,7]

Some practicing veterinarians have been keenly interested in this work, yet from a general standpoint breeders have been more interested than veterinarians and sometimes, in certain localities of the State, have experienced difficulty in getting the local veterinarian to carry out tests in their herds. Those who have cooperated with owners and the Bureau in conducting work of this character have found it both profitable and satisfactory. It is naturally a duty of state regulatory organizations to outline the policy and supervise work of this character which has to do with a transmissible animal disease. The practicing veterinarian should be guided by such a policy.

Veterinarians and breeders in one county have requested that several herds be used for demonstration purposes in their county. Steps have already been taken under the supervision of Dr. F. A. Marshall, to select herds and inaugurate the work.

The Jefferson County Fair, at Brookville, Pa., passed a resolution prohibiting the exhibition of cattle unless blood-tested and free from abortion. The Cambria County Fair set aside one stable in which to exhibit only abortion-free cattle.

Several inquiries have been received from breed societies, calf clubs and bull associations, which indicates keen interest on the part of these organizations. Several calf clubs and bull associations are already operating under the plan.

Dr. B. Scott Fritz, who is in charge of this work in the state institution herds, reports that control measures were instituted and testing was begun in 1925 in fourteen state institution herds. In some of these herds the plan has not as yet been carried out in its entirety, but in those where the herds have been separated into negative and positive groups, there has been nearly 100 per cent breeding efficiency in the negative groups and as high as 35 per cent abortions and considerable sterility in the positive groups. It was observed that as reactors were eliminated from the herds, the average milk production noticeably increased. The Official Milk Testing Association records on some of these herds indicated that the average milk production of reactors was approximately 20 per cent less than that of the negative cows. Mastitis has been generally very prevalent in the positive groups and practically absent in the negative groups.

The herd symptoms or manifestations of Bang bacillus disease have been described as retained placenta, sterility, calf scours and granular vaginitis, in addition to abortions. Our observations teach us that both calf scours and granular vaginitis are separate conditions or diseases which occur in herds free from Bang bacillus disease. Some cases of retained placenta and sterility occur in practically all large herds although the number of cases of sterility is considerably larger in infected than in free herds. Retained placenta should be looked upon as an indication of the possible presence of the disease in a herd rather than as a definite symptom.

The herd symptoms can be more definitely described as the occurrence of abortions and sterility; occasional acute rheumatic attacks with stiffness and elevation of temperature[8]; occasionally a bull with swollen scrotum, testicle and spermatic cord; big knees (bursal enlargements in region of carpus); udder troubles—mastitis; reduction in the amount of milk produced; scarcity of calves in calving season and a general herd inefficiency.

Our attention was first called to big knees by Dr. John N. Rosenberger who, on purchasing cattle from several herds for addition to free herds, found that most of the reactors either had an enlargement over the carpal region or evidence of mastitis, or both. Big knees are quite prevalent in abortion-infected

herds, especially Jersey herds. It has been our experience that most of all such cows from infected herds have reacted to the blood test. The question needs further study.

Our experiences indicate that the percentage of service bulls reacting to the blood test for Bang bacillus infection is just as high and possibly somewhat higher than that of mature females. Several cases of lesions found in reacting bulls have already been reported by Barnes and Brueckner.[9]

In only two instances where herds have been issued "abortion-free" certificates have the owners been unable to retain the certificates. In both these instances the owners failed to comply with certain parts of the Plan. One of them sent two cows to a fair for exhibition purposes. Six weeks after their return, one of these cows aborted and both of them reacted to the blood test, and three weeks later, out of twenty-eight animals in the herd, six reacted positive or highly suspicious. This owner had failed to observe Paragraph 17 of the Plan, which requires that animals removed from the farm for exhibition purposes shall be provided with separate quarters.

In one other instance of a herd holding a certificate a low reactor was removed and the certificate was conditioned for a period of thirty days, at the end of which time all animals passed a negative test.

In approximately twenty abortions which have occurred in negative herds we have been unable, except in a few instances, to demonstrate the cause of these abortions. In none of these cases could the Bang bacillus be demonstrated through a study of the placentas and aborted fetuses and none of the animals reacted to the blood test. In no cases where animals have remained negative to blood tests subsequent to aborting have we ever been able to demonstrate the Bang bacillus as the cause of abortions.

During the 1927 meeting of the American Veterinary Medical Association, in Philadelphia, Professor Bang, of Copenhagen, visited two herds from which Bang bacillus disease had been eliminated and expressed himself as well pleased with the results which had been obtained. During his discussion of this disease he stated that the use of the agglutination test and separation of reactors constituted the *best* method of control and eradication.

The complaint that laboratories do not agree in results and that the test is not standard, is not heard so frequently as a few years ago. In accordance with the Pennsylvania method of in-

terpreting results, we considered that there was practically 100 per cent agreement in the results obtained on five bovine sera sent from Pennsylvania to twelve different laboratories. These results have already been published.[10]

Pennsylvania has handled Bang bacillus disease purely from an economic standpoint, yet some of our dairymen producing certified milk have already advertised the fact that their herds are free from the disease. Cases of infection in humans that have been reported in the literature, combined with the fact that milk from infected cows contains Bang bacillus, have aroused the attentions of a number of boards of health. We understand that the Pennsylvania Board of Health Laboratory has installed facilities for testing all negative typhoid sera with a Bang bacillus antigen. There is little doubt that some time in the future herds producing certified raw milk will be required to be free from Bang bacillus disease.

FURTHER REPORT ON HERDS PREVIOUSLY REPORTED BY BARNES

This report is given for the benefit of those who were following reports on herds presented before the American Veterinary Medical Association meetings of 1924 and 1925.[2,11] Some have been particularly interested in knowing the outcome of herd 24.

The *First Herd* still holds "abortion free" certificate Number One. During the last year, 69 mature females gave birth to 73 calves. One cow was sterile and there were five sets of twins born. The herd now contains approximately 150 females of all ages.

The *Second Herd* had been keeping free from infection, yet animals have been purchased from time to time and kept isolated until after calving. Some of the purchased animals reacted, but were kept apart from the free herd. The owner of this herd had never signed the Pennsylvania Plan but practiced its principles. This herd has changed owners and what will be the outcome remains to be seen.

The *Third Herd* now has 77 pure-bred animals in the free herd. The last renewal certificate was issued in May, 1927. The owner reports that the herd is in a high state of efficiency, both from breeding and milk-production standpoints. The reacting unit has been reduced to only two or three animals or has been entirely eliminated.

Herd 24 now maintains approximately 130 mature females and approximately 250 females of all ages. No positive reactors have been found in this herd since March, 1925. Since that time three

abortions have occurred and all three were proved not to be due to the Bang bacillus. The manager estimates 98 per cent breeding efficiency in this herd.

Conclusions

1. The results of blood tests for Bang bacillus disease were previously improperly interpreted. Their true value is better understood today than it was previously.

2. Blood testing, elimination of reactors, practice of necessary sanitary measures and prevention of reintroduction of the disease constitutes an effectual method of control of Bang bacillus disease.

3. Previous comparative tests indicate that different state laboratories show a high percentage of agreements in results obtained.

4. The blood test properly applied after the occurrence of an abortion, based on Pennsylvania experiences, is sufficient evidence to indicate whether the abortion was due to Bang bacillus infection or not.

5. The percentage of service bulls infected with this disease is as high as that for mature females.

6. Young stock when maintained separate from mature infected animals are comparatively free from this disease and are ideal for herd foundation stock provided they are properly tested and free.

7. It is a duty of state regulatory officials to outline a policy for the control of this disease.

8. Practicing veterinarians should become familiar with their state policies.

9. Owners of abortion-free herds are enthusiastic. Breeders in general and many veterinarians are interested in the eradication of this disease.

10. Available evidence on this disease from a public health standpoint, and the attention being given it by boards of health indicate that we are no more justified in advocating the use of living culture vaccines today than we were in 1912.

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[4]Barnes, M. F.: Bovine infectious abortion. Jour. A. V. M. A., lxi (1922), n. s. 14 (2), p. 133. (Corrections, p. 460.)

[5]Deubler, E. C., & Barnes, M. F.: Sterility of cattle. Jour. A. V. M. A., lxi (1922), n. s. 14 (3), p. 254.

[6]Barnes, M. F.: Sterility of cattle. Jour. A. V. M. A., lxiv (1923), n. s. 17 (1), p. 83.
[7]Barnes, M. F.: Cattle abortion disease. Lantern slide lecture. Fairs 1923. Jour. A. V. M. A., lxv (1924), n. s. 18 (2), p. 221.
[8]Barnes, M. F., & Brueckner, A. L.: Bang bacillus disease (bovine infectious abortion) prevention and control. Vet. Med., xxii (1927), 4, p. 151.
[9]Barnes, M. F., & Brueckner, A. L.: Some cases of interest. Jour. A. V. M. A., lxxi (1927), n. s. 24 (4), p. 514.
[10]Barnes, M. F., & Brueckner, A. L.: Bang bacillus disease (bovine infectious abortion). Jour. A. V. M. A., lxxi (1927), n. s. 24 (5), p. 578.
[11]Barnes, M. F.: Bovine abortion—prevention and control—further remarks. Jour. A. V. M. A., lxviii (1926), n. s. 21 (4), p. 429.

PRESIDENT VAN ES: The next item on this morning's program is the report of the Committee on Abortion, and I will call on Dr. C. P. Fitch to present it. (Applause)

. . . Dr. Fitch read the report. . . .

REPORT OF THE COMMITTEE ON ABORTION

DR. C. P. FITCH, *Chairman*, St. Paul, Minn.

Dr. E. C. Schroeder, Bethesda, Md. — Dr. Geo. H. Hart, Berkeley, Calif.
Dr. Ward Giltner, East Lansing, Mich. — Dr. F. B. Hadley, Madison, Wis.
Dr. M. F. Barnes, Philadelphia, Pa. — Dr. W. H. Welch, Lexington, Ill.

The report of your Committee on Abortion has varied materially from year to year. For a long time this Association failed or, more accurately, refused to recognize that there was a specific disease due to a particular microorganism, *Bact. abortus*. It is still not clear to many that the act of abortion may be due to a variety of agents, both animate and inanimate. and further that the expulsion of an immature fetus may or may not be a symptom of infection with *Bact. abortus*.

Following the adoption of the report of the Committee on Abortion, in 1925, your Committee last year reported the progress that had been made in the control of this disease which has no equal in economic importance. It is the purpose of this report to outline the work which has been carried on during the last twelve months and to point out certain salient facts which have already been demonstrated.

Your Committee has received a reply from the sanitary officer in charge of live stock disease control in every state of the Union. Some, it is true, have been very terse and others were forthcoming only after repeated requests by letter and telegram. The information conveyed in these communications is very encouraging and shows that a real effort is being made to limit the ravages of this bovine scourge. Nine states have adopted specific control measures. These vary markedly depending upon local conditions. Some of the state legislatures have enacted definite statutes, while other are regulations of the live stock authorities of the respective commonwealths. Educational or demonstrational work of some kind is being carried out in twenty-three additional states. This leaves but sixteen states in which little, if anything, is being done. The testing of blood specimens for the presence of *Bact. abortus* antibodies, is being carried on by laboratories in twenty-four states. Vaccination is being recommended as a method of control by only three states. It is significant that demonstrational herds, free of this disease by the blood tests, are being established in twelve commonwealths. The last two years have seen marked advances in the interest of the live stock public toward this disease. In this connection it should be pointed out that eight control officers located in states which are doing practically nothing to control this infection, frankly state that some method should be adopted to stop its spread. Lack of available money to defray the expense of control measures is the cause of no work being done in many cases.

The measures used to control the disease depend somewhat upon the local conditions in the state. For example, some of our southern states, as Arkansas, South Carolina and Georgia, have regulations or laws requiring that all cattle transported or otherwise brought into the state, must show on the health certificate that they have satisfactorily passed a blood test for bovine infectious abortion. These states do not have as large a proportion of infected

herds as certain of our northern, more extensive dairy and beef-producing states. They are therefore protecting their herds from further infection from outside. These southern states are now attempting to put in operation methods that will reduce the infection already existing within their confines. These methods vary and include: (a) immediate slaughter of reactors, (b) complete segregation of reactors, (c) sanitation, (d) injection of vaccines. In all cases these methods are largely experimental, in order to develop some plan of control that will fit local conditions.

Montana, as a typical range state, reports:

"The more we work on abortion disease, and the greater our efforts to control its spread and eradicate it on individual farms, the more we realize the difficulties this disease presents.

"We have eradicated abortion disease on individual farms by repeatedly blood-testing the entire herd and destroying the reactors. In one particular herd we started in with the idea of testing every 60 or 90 days. We found this was a mistake and that the test should be made, in badly infected herds, not less than every 30 days, as some infected animals will not give a positive reaction until about the time of parturition. For that reason we do not accept as final a negative test on pregnant animals, but retest such animals not less than ten days after parturition.

"It has been our experience that if sanitary precautions and proper control and quarantine measures are left to the ordinary herdsman that they will not be effectively carried out. Some little slip will take place that, to the herdsman, is negligible but, to the sanitarian and insofar as the spread of infection in the herd is concerned, is all-important. Every detail relative to how the herd is to be handled should be written out, and the enforcement of these details absolutely carried out in every particular. It has been our experience that verbal instructions are liable to be misunderstood or forgotten, and can not be depended upon.

"We believe that the blood tests in use at the present time are reliable and can be depended upon in non-pregnant animals. We believe that a blood test should be used in all herds where abortion is present, and when used on non-pregnant animals the findings should be accepted without question. Animals which give a positive reaction should either be slaughtered or segregated and handled in such a manner so as not to contaminate common pastures or spread the disease directly to other animals. In infected herds, pregnant animals should be kept separate from non-pregnant animals."

Pennsylvania and New Jersey have the most comprehensive laws in respect to the prevention and control of bovine infectious abortion. You have already heard, from the live stock sanitary authorities of Pennsylvania, how their plan is working. New Jersey reports as follows on results obtained under their law:

"In the report submitted last year attention was drawn to the passage of the bill by the Legislature of New Jersey giving the Bureau of Animal Industry, Department of Agriculture, authorization to institute measures for the control and eradication of bovine infectious abortion.

"There were appropriated funds for the establishment of a laboratory to make tests for the detection of this disease. The services of an expert veterinarian were secured and the work has progressed very satisfactorily.

"During the past year there has been considerable interest manifest both among the breeders of purebred cattle and dairymen managing grade herds. We have only accepted applications to place herds under supervision where quarantine measures could be properly carried out.

"The plan we have adopted is to organize and maintain quarantine farms with no other animals but those that have reacted to the abortion tests to be maintained thereon. We have, at the present time, six such premises. The owners are maintaining these herds in a successful and satisfactory manner. We also have three herds where a limited number of reactors are being maintained on the same premises with healthy

cattle. While this plan has proven of value, we do not consider it ideal nor recommend its adoption.

"We have at the present time twenty-eight herds comprising 767 animals that are being maintained under cooperative supervision. We have made a number of tests of one or more animals in herds where contagious abortion was suspected and where such animals have reacted they have been disposed of either by movement to quarantine farms or slaughter.

"A careful system of checking tests has been carried out with other reliable laboratories, so we feel that the plan is on a safe foundation.

"Two herds have been accredited and there are a number of herds due for accrediting tests which will soon be made.

"The New Jersey statutes provide a penalty for any person moving into the State, animals that have reacted to the abortion test and the Board of Agriculture, when deemed expedient, is empowered to make and enforce rules and regulations prohibiting the interstate movement of dairy and breeding animals that have not passed a successful test for the determination of contagious abortion."

One state reports:

"Many veterinarians also seem to get favorable results from abortion bacterins, but the larger per cent seem to believe that by supplying a proper mineral mixture, results are more beneficial."

Your Committee does not agree with this statement, as there is no experimental work which shows that abortion, under natural conditions, results from lack of minerals, and repeated and long continued experiments have demonstrated the futility of bacterins as immunizing agents. Kansas reports that only three cases of contagious abortion have been reported to the office of the Live Stock Sanitary Commissioner, during 1927. This state recommends segregation and antiseptic treatment of infected animals. They state:

"Therefore, since we have had so few cases reported this year, we are of the opinion that our present control method is an efficient one."

Nebraska reports:

"We are not unmindful of the needs of specific regulatory measures, but we are unwilling to attempt any specific regulatory measures under the present knowledge of handling contagious abortion. We are not in a position to criticise the several different attempts being made to control the disease, yet we can not accept for adoption, a similar plan to any outlined as practical under Nebraska conditions."

Minnesota has adopted a plan modeled after that of Pennsylvania. Only one herd has been signed up. On the other hand, private practitioners are testing many herds throughout the State and putting into practice methods of segregation, disposal or slaughter, which fit the local condition. Many herds are being periodically tested and the results are very encouraging. The most significant fact noted in this State is the increased interest of the owners of live stock to the importance of having herds free of this disease.

All veterinary sanitary officials should bear in mind the relation bovine infectious abortion has to human health. Your Committee has not placed papers dealing with this phase of the subject on the program, because sometimes papers of a similar nature have received undesirable newspaper publicity. Research work has demonstrated a definite connection between the Bang organism and human welfare. Those concerned with the protection of human health are recognizing more and more fully the problem which this fact presents. Three papers on this subject were presented before the meeting of the American Public Health Association recently held in Cincinnati. Veterinarians should keep in close touch with the researches that are being conducted on this subject and live stock disease control organizations should be ready at any time to offer advice or assistance in connection with the human aspect of this disease. It is recognized, of course, that pasteurization of infected milk gives a high degree of safety for the use of this product. We also desire to point out that dairymen producing certified milk should certainly exclude bovine infectious abortion from their herds.

In conclusion your Committee desires to point out:

1. Laws and regulations tending toward the prevention and control of bovine infectious abortion are being adopted each year by the legislatures and animal disease control organizations of certain states.

2. States which are not safeguarding the herds within their confines from further infection, or which are not attempting some measures tending toward the control of the infection already present, are now decidedly in the minority. The control officials in these states should study their local situation and adopt procedures which will either prevent infection in a clean territory or control the existing disease.

3. Further experimental work reported has shown that vaccines used over long periods are not reliable agents for the control of bovine infectious abortion.

4. The reliability of the blood tests as methods of diagnosis has been clearly shown. Certain limitation of the tests have been pointed out and their value in the control of this disease is definitely established.

5. Educational procedures have had very beneficial results as shown by the increased interest of the live stock-owning public toward the control methods and the rapidly increasing desire of live stock owners to have herds free of the disease.

6. It is not yet time to recommend uniform methods of control. Many states are doing a pioneer work demonstrating the efficiency of their control measures. States which are doing nothing to protect their herds will soon find themselves in a serious situation.

DR. FITCH: Mr. Chairman, I move the adoption of the report.

. . . The motion was regularly seconded and carried. . . .

DR. GEORGE HILTON: May I be permitted to draw the attention of this Association to the absence of one of its most prominent members, a gentleman of high scientific attainment, who has always taken a keen interest in the work of this Association, and who has made many valuable contributions to the program. He has been prevented from attending this meeting owing to a very unusual, trying experience, due to family illness.

I refer to Dr. Schroeder, who is himself in very poor health. I would, therefore, move, Mr. President, that the Secretary be asked to forward a letter, couched in suitable terms, expressing the sympathy of this Association in the very trying circumstances through which he is passing.

DR. FITCH: I second that motion.

PRESIDENT VAN ES: With the consent of the assembly, we will entertain that motion. Are there any remarks?

. . . The question was called for, put to a vote and carried. . . .

PRESIDENT VAN ES: We can now proceed with the discussion of the papers that have been presented on the question of abortion. It is an important subject. No doubt questions may come to you that the gentlemen who so kindly read the reports are willing to answer.

DR. J. W. CONNAWAY: I think this would be the first time in the history of this Association that no discussion followed the presentation of papers like these. It may be that our progress in the right direction has been so marked there is not very much need for discussion.

I mentioned to Dr. Church and Dr. Barnes that I find only one objection to their paper, and that is that every line is not underscored, and the whole of it is not printed in red. Furthermore, I wish that this paper could go into the hands of every veterinarian in the United States and into the hands of every cattle-breeder, because they have presented the right procedure for the handling of contagious abortion in animals.

Long before I heard of the Pennsylvania Plan, we were carrying it out in its essential features in Missouri, starting with a serious outbreak of contagious abortion in our own state farm dairy herd. We ran through the carbolic acid treatment, methylene-blue treatment, and all of that experience. With the development of the serological tests we instituted a monthly test of our herd, from old cows to suckling calves, and we kept that up for

a number of years. We eradicated the disease from that herd by the segregation method, and through the elimination from the herd, by way of the butcher's block, those animals which, through this disease, became unprofitable to keep in the herd.

Our experiences in our own herd led us to try this on herds in the State, and from the beginning of this work up to date we have tested over 1000 herds of Missouri dairy cattle and beef-bred cattle, including something over 16,000 head of animals, and the dairymen of our state and the breeders of beef cattle, who have tried it, like it; they commend it. Not one of these men, so far as I know, has any criticism of this plan. I think it is our only way out of these troubles.

There are occasions when we have a herd that is badly infected, and valuable animals too. The question is: "How shall such a herd be handled, and especially where the owner does not have what he thinks are adequate facilities for segregating the infected animals?" My observations have been that he is inclined to magnify the difficulties in the way of segregating the infected animals. We have found that a woven-wire fence is a sufficient quarantine barrier to keep the infection from one side going to the other, if you have your infected animals on the lower ground so that the drainage is away from the healthy group. I believe the farms are very few where these isolation methods cannot be carried out, and especially so in the case of beef-bred herds. There are some difficulties where a dairyman wants to milk some of the infected cows, but since we now know there is some danger of transmitting this disease to the human, the arguments are all the greater for eliminating the abortion-infected cows from the milking herd.

From the report, the Committee is inclined to believe we are not yet ready for a uniform way of handling this disease. I believe we are ready right now to put on an interstate quarantine. This must come; it has to come, and we have the machinery already established to carry it out. The same official machinery which is now in operation to prevent the spread of tuberculosis from state to state can carry this along right with it.

In Michigan they have the laboratories for testing every animal that goes out of that state into another state. In Missouri we have the facilities for testing every animal that needs to go to other states, and we are doing a lot of that testing work on animals that are shipped out into western countries. Every state, I think, which has these facilities, should encourage that.

As to these immune animals for which our Michigan friends have discovered a method of picking out: I have some serious doubts as to whether that so-called immune animal is, in fact, a non-infected animal. I recall inoculating a steer, an animal that had neither testicles nor uterus, nor an udder, that carried that infection, or at least reacted to the injections we made into that animal, over a period of three years. These tests were made monthly, and there were fluctuations up and down in the tests we made on that animal. There came a time when we thought that that animal had ceased to react. There were months and months when that animal did not react, and we were on the point of injecting that animal to see if we could bring up that reaction again. We drew blood, and that same day we injected this animal and got a fine positive reaction. It had come back again. I am confident that in this animal we had living germs that caused those fluctuations.

I believe there are some animals that do become free from the disease, but there are many that do not.

In this immune group it looks to me as if we have a reaction that is right on the border-line of a doubtful reaction, just as you have in your tuberculin work. I would suggest that in this work those same so-called immune and thought-to-be-free-from-infection animals be watched, and see if later on you do not find the infection in those animals.

In Missouri we do not want any of your immune reacting animals. In Michigan you have enough healthy animals to meet the needs of the state of Missouri for the kind of breeding stuff we have. We get some animals from Minnesota, and we sometimes get bred heifers that come to us and abort and start the disease in our herds. We do not want those. We want you to test every breeding animal that comes to the state of Missouri. We

want to trade with you. We want your good stuff; we want your healthy animals for building up our herds. Some day we are going to compete with you in the markets for milk products, but we have to come to you for that better-bred stuff.

I do not want to picture the dairy industry of Missouri, and especially of that Ozark country like my friend, the State Veterinarian, Dr. Wilson, did with reference to hogs. There is a region which is destined to become one of the best dairy sections in this whole United States. To do that, we want more of your well-bred, high-test dairy animals. We are willing to pay your price for them, but we want them free from tuberculosis. We want them free from abortion disease. In the meantime, we are trying to get rid of that which we have, and I think we are going to do it.

One of our obstacles at the present time is the commercial, biological-house propaganda, "that the only way to handle this matter is through active immunization of these animals with the living germs." We have to overcome that in some way. Education will do it. The paper that Dr. Church has read is the kind of propaganda we want to put into every state in this Union, and there is no better and more efficient educative measure than quarantine. We must have that. We must have interstate quarantine against this disease at the earliest possible moment. I do not pretend to say when that moment shall be. I think it is now, but there are differences of opinion as to that, and I am in favor of waiting for it. I am not going to advocate in my state that our Sanitary Board shall put on a quarantine against other states. I would rather see the United States government put that on, because it is needed. These people in the South have pointed the way. They intend to protect themselves, and it is right; every state should do it.

Dr. Fitch has pointed out some of the difficulties of educating the herdsmen. Many of these you never will educate. Hence, the necessity of a measure which is the best educator and the best protective measure that can be applied, namely, interstate quarantine against all infectious diseases. It will come, some of these days, with reference to avian tuberculosis. It has got to come before we can control it. There is a disease which is spreading from the North to the South. These things can be carried out. (Applause)

DR. FITCH: Just two points. One is in regard to drainage. We have been carrying on an experiment, in which that was a factor, at University Farm for four years, and we have not found that drainage is an active source of spread of the disease, as it may be in the case of tuberculosis. The organism is not so long-lived, does not live so readily outside the animal body as does the tubercle bacillus.

Another fact that live stock sanitary officials of all states, in which blood testing is being carried out, will have to take into consideration before long is the sale and disposal of animals which are reacting to this test. It is very questionable, in my opinion, whether these animals should be allowed to go into communities where disease-free animals are.

DR. BIRCH: There is one point in regard to the difference in the reactions between the infected and the immune animal. I know nothing about the test. I do not know whether that is a differentiation in that respect. I do know that in following out infected animals, animals in which we cannot get the organism from the milk and from the uterine discharges at time of parturition, we have animals of that kind that react for years, and when we kill them we invariably get the organism either from a lymph-gland, particularly the supramammary, or the spleen, or from some other organ. While we have said this is always true, we regard it as the usual thing that when an animal is reacting above 1-80 there are just two possibilities. The chances are the animal is infected and is at that time a definite carrier of the organism. The other possibility is that the disease has already disappeared and is on the decline. We do not hold to the opinion any more that the agglutination reaction stays up indefinitely for a long time after the disappearance of the organism from the body.

There is another suggestion I should like to make in regard to the interstate movement of cattle, I am agreed that that supervision should exist, that the more effective it can be made, the better. Up to this point, I believe

a state should take the stand that it will know what is inside of its borders. I do not believe any state wants to go to the extreme of saying that no abortion-infected animal shall enter its borders unless it is ready at the same time to exclude shipments altogether.

We have a great many herds in the older dairy states in which there is a high percentage of reactors. If a man wishes to buy cattle, the best animal he can buy is a long-time reactor, which is a good breeding individual. To turn it around, if we say he shall buy only clean animals, we have condemned him to one of two things. We have condemned him either to the introduction of clean animals and their subsequent infection, or else we have condemned him to the policy of excluding animals altogether. This supervision should exist. It is good education. It is a good educative measure to say the test shall accompany the individual, but the state veterinarian should reserve to himself the power of distribution of animals and, if he sees fit, to admit the animals within the state.

DR. W. J. BUTLER: I think we all recognize that this test is not positive or all-reliable in pregnant animals. Of what use or what service is the regulation requiring a blood test on all animals? If you get a blood test on a pregnant animal and you can not rely on that test, of what service is it to you? Is there not going to be a kick-back, if you will pardon the expression, on the sanitary board that will say to its people, "We will permit the importation of abortion-free cattle only and will protect you by this blood test," when that blood test is unreliable and is simply a snare and a delusion, as far as the protection of the live stock is concerned? I would just like to ask that question. Why do you require a blood test on pregnant animals when that blood test is not reliable?

DR. BIRCH: I think probably Dr. Butler has the wrong impression about the reliability of the agglutination test on pregnant animals. The exception is the case in which we find the organism subsequent to the abortion and do not find it before. We do not want you to get the idea that it is not reliable on pregnant animals. We can say only that it is a little less reliable on pregnant animals, but if we make a test and get a reaction in a good, high dilution, we may be just as sure that we have infection with the organism as we are when we are out in the woods hunting, see a rabbit track and assume the rabbit passed that way.

DR. CONNAWAY: On that very point of admitting the long-time reactor, which we firmly believe is not as dangerous as the animal which has recently aborted: I brought that matter up with Dr. Bahnsen before he issued his quarantine regulation. I happened to be invited to Georgia to attend a meeting of veterinarians and dairymen, to discuss this matter of abortion disease. Dr. Cotton, of Washington, was at the same meeting, and we gave those men all the information we could in regard to the nature of this disease, how it spread, and herd management methods by which it could be controlled. Neither one of us said anything about interstate quarantine regulations, but after this meeting, Dr. Bahnsen told me that he was going to put on this regulation, and I pointed out that it was possible to take over the quarantine line certain individuals that might be reactors, that is, these long-time carriers, in which the germs had no doubt become greatly mitigated, animals which were dropping calves regularly.

He said, "I am going to cut out every animal that reacts. If I were to make that exception, it would be simply a loophole through which many others that were dangerous would pass." I believe he is right. If that cow is especially good for the South, below the quarantine line, why should it not be just as good right in that man's own herd? I think every reacting animal should stay right on the farm where it acquired the disease until that animal goes to the butcher's block. You can raise good young heifers from that animal. After they have developed this resistance to the disease, you can sell calves, young heifers that are better than that old cow, and for more money, and the man who is building up a new herd wants that kind of stuff. There are not many of them, except the speculator in diseased animals, who want to deal in that class of animals. The buyer must be protected.

PRESIDENT VAN ES: If there is no further discussion on abortion, we will proceed with the program. The next number is entitled, "Anaplasmosis of Cattle in the United States," by Dr. L. T. Giltner, of the U. S. Bureau of Animal Industry. (Applause)

. . . Dr. Giltner read his paper. . . .

ANAPLASMOSIS OF CATTLE IN THE UNITED STATES

By L. T. GILTNER, *Washington, D. C.*

Pathological Division, U. S. Bureau of Animal Industry

In their early investigations of Texas fever, Smith and Kilborne[1] frequently observed mild secondary attacks occurring usually in the fall of the year and terminating in recovery. Blood examinations in those cases always revealed what they termed coccus-like bodies, located in most instances near the margin of the red cells and occasionally more centrally. These forms were considered, at the time, as representing possibly a development stage in the life cycle of *Piroplasma bigeminum*. However, from further descriptions of the disease and of the marginal bodies discovered in the erythrocytes, one may feel certain that they were dealing with anaplasmosis which had followed an earlier attack of Texas fever, or true piroplasmosis.

It was not until nearly seventeen years after the studies of Smith and Kilborne were completed that Theiler[2] announced that the small marginal bodies belonged to a distinct species of hematozoa which he named *Anaplasma marginale*. He found what he considered a pure infection of anaplasmosis in a bovine and through immunity experiments showed that that disease could be separated from Texas fever.

K. F. Meyer[3] appears to be the first to record experimental evidence of recognition of the affection in this country. He conducted his experiments in an absolutely tick-free region in the winter and with cattle that never came in contact with ticks. A cow which was inoculated with blood from a Texas fever case from Florida developed a severe case of anaplasmosis in twenty-six days and died on the thirty-third day.

Meyer saw no early febrile reaction in this animal corresponding to the incubation period of Texas fever but by dint of hours of careful microscopic study found a few *P. bigeminum*. Thus he considered there was a mixed infection of anaplasmosis and true piroplasmosis. Quite recently K. F. Meyer[4] observed three spontaneous cases of pure infection in California. This, he states, is the first published finding of pure infection in North America.*

*The writer is informed by Dr. Meyer that the cases referred to were observed through the courtesy of Drs. Boynton and Haring, to whom should be given the credit for their discovery.

In the fall of 1924 Dr. E. Pegram Flower called the attention of the Bureau to a disease of cattle near New Orleans which he considered to be anaplasmosis. Bodies resembling *A. marginale* were found in the red cells and the clinical picture fitted that of anaplasmosis. The affected animals were in an absolutely tick-free area. Blood from one of these cases was forwarded to the Bureau and Dr. H. W. Schoening made a series of inoculation tests in cattle and sheep but observed no symptoms of anaplasmosis in any of the animals after a period of observation of over four months. Likewise blood examinations failed to reveal the presence of the marginal bodies.

Darlington,[5] in 1926, published an excellent account of the disease as he saw it in southeastern Kansas. The symptoms and autopsy findings in his cases closely resembled those observed by the writer in cases occurring this year in Florida. Darlington found no ticks on any of his cases.

During the winter of 1926-27, Haring and Boynton observed cases of bovine anaplasmosis on farms in Contra Costa County, California.. They found the marginal bodies in the red cells and also the severe anemia so typical of the disease. Blood from affected animals inoculated into susceptible bovines caused typical symptoms of anaplamosis with the occurrence of the anaplasmata in the erythrocytes.

Two species of ticks were found on the infected cattle, viz: *Dermacentor occidentalis* (western dog or wood tick) and *Ixodes ricinus* var. *Californicus* (common deer and cattle tick of California).

During the late summer of the present year, the Bureau received communications from Dr. A. D. Knowles, of Kelsey City, Florida, and Mr. Henry S. Pennock, of Jupiter, Florida, in which was described a malignant disease of dairy cattle diagnosed as hemorrhagic septicemia but which failed to be checked by specific aggressin treatment. Dr. Knowles forwarded a specimen of blood from one of the affected animals on August 10, and this material which had been carefully collected and packed in a thermos bottle was received in excellent condition. Believing that he had satisfactorily excluded hemorrhagic septicemia, Dr. Knowles suggested the bare possibility of the disease being rinderpest. Accordingly, Dr. H. W. Schoening, of the Pathological Division, inoculated three cattle with this blood, as well as some small laboratory animals, and prepared cultures. As no reaction followed the inoculation of the cattle after a period of observa-

tion of over two weeks and since the small animals remained healthy and the blood cultures remained sterile, it was concluded that the disease in question was neither rinderpest nor any of the well-known acute bacterial diseases.

Opportunity was then afforded the writer to visit Mr. Pennock's farm and study the disease. The history of the outbreaks, together with the clinical and autopsy pictures, strongly suggested braken poisoning as described by Stockman,[6] in England, and Hagan,[7] in the United States. However, after cultural study of two typical cases, as well as numerous microscopic examinations of blood-films, it was found that we were dealing with a non-bacterial disease, accompanied by very marked anemia, with the occurrence of numerous small bodies in the red cells resembling *A. marginale*. Moreover, the cattle already inoculated at the Bureau Experiment Station gave evidence of a reaction on the thirty-second day of incubation and a few marginal bodies were found in the red cells. Within a short time, typical symptoms of anaplasmosis developed and it was possible to make a positive diagnosis.

In October of this year, Dr. Geo. W. Stiles was directed by the Bureau to investigate a disease of cattle on a ranch near Ponca City, Oklahoma. From clinical, postmortem and blood examinations a prompt diagnosis of anaplasmosis was made. Thus, Oklahoma was added to the list of states in which the disease has definitely been proved to exist.

Geographical Distribution

Like Texas fever, anaplasmosis is a disease occurring naturally only in the southern states, Kansas being the most northerly. In other countries the affection is likewise found only in the warmer latitudes. In Africa it has been diagnosed in the Karoo, by Theiler, in 1910; in Kapstadt, by Spreul, in 1910; in Rhodesia, by Bevan, in 1912, and by Chambers, in 1913; in German West Africa, by Leipziger, in 1910; in German East Africa, by Lichtenfeld, Olwig and Manteufel, in 1916; in Uganda, by Bruce and his collaborators, in 1910; in Sudan, by Balfour, in 1911; in Eritrea, by Carpano, in 1912; in Kamerun, by Ziemann; in Algeria, by Sergent and Begnet, in 1913; in the island of Madagascar, by Carrougeau, in 1913; and in Morocco, by Velu, in 1920.

In South America, Lignières, in 1911, found what he considered as a new species (*A. argentinum*) in Argentine cattle and Carini discovered the same parasite in 1911, in Brazil. In 1914,

Descazeaux also found anaplasmosis in Brazil. In Asia, Koidzumi encountered the disease in 1912, in the Island of Formosa; de Blieck and Kaligis, in 1912, and Buggeman, in 1917, found the affection in the island of Java; and Boynton, in 1917, saw cases in the Philippine Islands. In Europe Carpano found anaplasmosis in Italy, in 1912, and Dschounkowsky and Luhs, in 1904, observed the disease in Transcaucasia, but considered their forms of piroplasma as *Theileria annulata*. Yakimoff encountered anaplasma, mixed with *Gonderia mutans*, in Russian Turkestan. In the summer of 1926, W. L. Yakimoff and W. S. Belawine[8] discovered a case of pure anaplasmosis in Piatigorsk, Transcaucasia.

Anaplasmosis, as we observed it in Florida, this year, assumed a very virulent form, the losses amounted in some instances to 30 per cent of the herd. The first cases developed about the first of June but the disease did not become alarming until August, when several animals fell ill each day. The infection attacked adult cattle most often; only one case was seen in an eight-months-old heifer.

Symptoms

Generally the first symptom noticed is a diminution in the milk secretion, but for several days the animal may have a nearly normal appetite. Then there is marked weakness; the gait is stiff and there is a tendency to lie down frequently. Coincidently there is almost complete suppression of the milk-flow, with loss of appetite and cessation of rumination.

There is a decided costiveness and more rarely a diarrhea with occasionally blood-tinged feces. The urine is normal, never bloody. The temperature is usually high at the appearance of the first symptoms ranging from 104 to 107° F. and may remain thus for several days. In our experimental cases the thermic reaction was rather irregular, there being intermittent fever for a period of about two weeks. As the animal becomes weaker and remains recumbent, the temperature falls to about normal and shortly before death may be subnormal. Respiration is very short and rapid (60 per min.) and accompanied with grunting. The pulse is likewise greatly accelerated (120 per min.). There is lachrymation and often drooling of saliva. The visible mucosae of the head are very pale and occasionally slightly icteric. There is always a marked falling-off in weight, the animals having a very gaunt appearance with sunken eyes. In fatal cases death may ensue in from two days to a week or more from the onset of

symptoms. In our experimental cases infected with the Florida virus no fatal cases have occurred after three passages. Many cases recover but the convalescence is remarkably slow, usually requiring several months before the animal regains its normal condition.

Changes in the Blood

The most characteristic feature of the disease is the severe anemia which persists for a long time after the acute symptoms subside. If a superficial vein is severed, the blood flows freely and has a decidedly watery appearance. Microscopic examination of blood-films reveals a picture of pronounced anemia. There is well-marked anisocytosis, polychromasia, punctate basophilia and occasionally nucleated erythrocytes. There is a considerable increase in the number of platelets. In one of our experimental cases blood-counts made at the height of the reaction showed a reduction of nearly 3,000,000 red cells (actual count 3,264,000) per cmm.

The marginal bodies generally begin to appear in the red cells before the occurrence of the febrile reaction. At first only a few are formed but in a few days they greatly increase in number. We have observed them in the proportion of at least 303 per 1000 red cells.

The marginal bodies which we observed in the Florida infection appeared similar in all respects to those already observed by workers in various parts of the world. Their size varied from about 0.2 μ to 0.8 μ in diameter and their outline was nearly circular. They were situated for the most part near the margin of the red cell, sometimes more centrally. From a number of counts we found that there were about four marginally located bodies to one central form. They usually occurred singly but quite frequently two, three or even four bodies appeared in a red cell. Stained by Romanowsky or Giemsa, we were unable to differentiate cytoplasm and nucelus.

Nature of the Causative Organism

At present there seem to be two views regarding the nature of the anaplasma. By some observers anaplasmosis is thought to be due to an invisible virus and the marginal bodies are not considered protozoa but forms similar to Jolly bodies which occur in the red cells in anemic conditions. K. F. Meyer[4] who holds this view, states that in anaplasmata it is not possible to differentiate protoplasm and nucleus; that no developmental stages are

known and that anaplasmosis has an unusually long incubation period for protozoa. The original view of Theiler, that anaplasma is a protozoan parasite, is held by many. In support of the protozoan nature of the bodies, there is some negative proof. Both Theiler and K. F. Meyer failed to reproduce the disease with Berkefeld-filtered blood containing many anaplasmata.

Sergent and his coworkers[9] state that *A. marginale* does not pass through Chamberland filter under pressure of 5 cm. Hg. The marginal bodies in experimental cases, produced with pure virus, always appear in the red cells before the various lesions of anemia; polychromasia, stippling and normoblasts.

It is not definitely known whether or not there are more than one species or varieties of *A. marginale*. Recently Sergent and his coworkers[9] in Algeria have shown that the Algerian anaplasma immunizes against the Argentine anaplasma and reciprocally, and they consider *A. marginale* of Algerian origin as specifically identical with *A. argentinum* Lignières.

Incubation Period

The incubation period in anaplasmosis appears to depend considerably upon the quantity of blood inoculated. In one animal injected intravenously with 4.5 cc of blood from a sick Florida cow, the parasites were first observed in the blood of the thirty-second day. Two days later, there was an elevation of temperature. In a second passage of the virus, using 50 cc intravenously, the marginal bodies appeared on the sixteenth day. The incubation stage was nineteen days on the third passage, in which 20 cc of blood was injected subcutaneously. The sequence of the reaction phenomena following inoculation, as we saw them in experimental cases, was first the appearance of marginal bodies, very shortly, usually a day or two, succeeded by thermic reaction and then the appearance of abnormal forms in the erythrocytes. In experiments with ticks, Theiler noted an incubation period of from 60 to 100 days and Helm[10] observed a case with an incubation period of 59 days following infection by larvae of *Ixodes ricinus*.

Ticks and Flies as Vectors

In the United States the outbreaks of pure infection have occurred in tick-free areas. As already mentioned, Haring and Boynton found a few wood and deer ticks. Dr. Applewhite discovered one specimen of *Ixodes ricinus* on one of the Florida animals. What connection, if any, these ticks have with the

transmission of the disease in this country is not known. Theiler succeeded in transmitting the infection by the blue tick (*Boophilus decoloratus*) and the black tick (*Rhipicephalus simus*). Helm[10] showed that the larvae of *Ixodes ricinus* hatched from ticks that had fed on infected cattle were capable of transmitting the affection. Rosenbusch and Gonzales, in Argentina, succeeded in demonstrating that the sheep tick (*Margaropus micropilus*) was capable of transmitting the infection when the outside temperature was high (above 34° C.).

It has been suggested that inasmuch as anaplasmosis in the United States occurs in the absence of ticks, some of the biting flies, notably the large black horse fly (*Tabanus atratus*) or even mosquitoes and sucking lice may play the role of vectors. However, no proof has as yet been brought forward to support this suspicion. The writer received several specimens of *Tabanus atratus* recovered by Dr. Applewhite from infected cattle in Florida. A suspension of these flies in saline, injected subcutaneously in a calf, has failed to produce the disease up to the present time (31 days). Control calves inoculated with blood from a sick cow developed symptoms after an incubation period of 19 days.

Of the various animal species, only cattle show decided reactions to the infection. Sheep which are entirely insusceptible to *P. bigeminum* may act as retainers of the virus of anaplasmosis for several months without showing either fever or other symptoms of illness. Lignières found goats also slightly susceptible to anaplasma infection, but Sergent and his coworkers were unable to infect those animals.

Repeated passage of *A. marginale* from bovine to bovine does not exalt its virulence. After three successive passages of the Florida virus in cattle we saw no modification in the virulence. Lignières believes that passage through sheep or goats tends to weaken the virus.

Postmortem Findings

The chief pathological alterations found at autopsy are a marked flecking of the pericardium, epicardium and pleura, with petechiae and ecchymoses. There are often numerous light greyish areas in the heart muscle which histologically appear as degeneration of the muscle fibers. The lungs may be normal or present a few congested areas. We saw several cases of marked interstitial and vesicular emphysema. The liver is enlarged,

congested and histologically shows very pronounced parenchymatous degeneration. The gall-bladder is distended with very thick, dark-green bile. The contents of all four stomachs are quite dry but otherwise these organs present few abnormalities. There may be a catarrhal enteritis with evidence of hemorrhage from the mucosa. The spleen is greatly enlarged and dark-colored with jam-like pulp. There may be subcortical petechiae of the kidneys which otherwise are normal. The blood and muscles are pale and the lymph-glands are usually enlarged and edematous. The skin may have an icteric cast. However, we did not see marked icterus of any of the tissues in the Florida cases.

Differential Diagnosis

In the differential diagnosis of anaplasmosis, the following affections should be considered, viz., Texas fever, hemorrhagic septicemia, anthrax, rinderpest and plant poisoning, including bracken and soybean meal. The principal points of difference between Texas fever and anaplasmosis are the occurrence of hemoglobinuria, *P. bigeminum* in the red cells and, in this country, the presence of ticks on cattle suffering with the former disease. In all the other diseases mentioned, anemia is never a characteristic feature. Clinical examination supported by microscopic study of blood-films should suffice for this differentiation.

Treatment

No specific treatment such as trypan-blau in Texas fever has been discovered for anaplasmosis. Sergent and his coworkers[9] failed to find the intravenous injection of any of the following agents effective: methylene-blue, novarsenobenzol, stovarsol, dihydrochlorid of quinin or emetin hydrochlorid. They also found that a decoction of the bark of tamarisk-root given by mouth was without result. Yakimoff and Belawine[8] treated one case successfully with arrhenal subcutaneously and *Folia digitalis* and sodium sulphate orally. Darlington reported good results from the use of soamin (Burroughs Wellcome & Co.), combined with symptomatic and supportive treatment. In Florida, mercurochrome and acriflavine used intravenously did not appear to be efficacious.

A number of workers have already shown that recovery after an acute attack is followed by a state of relative immunity which persists as a chronic infection, probably for many years. Severe reinoculations into animals possessing this immunity never

result in marked reactions. Sergent and his coworkers[9] in Algeria have termed this type of immunity premunition and have described a method of obtaining it in practice by use of what they call "incubation virus." The procedure consists in inoculating a susceptible bovine intravenously with 50 cc of blood from a known chronic case of anaplasmosis. Then after the fifth and sixth days of incubation, the inoculated animal is bled in sodium citrate (1 per cent) and this blood is held at a temperature of 12-21° C. (53.6-69.8° F.) for three days, when it is ready for use. Animals to be immunized are injected with from 2-5 cc subcutaneously. In their experimental cases this method proved successful; no data were given for field cases.

Lignières made use of virus after passage through sheep and regards the method as safe and reliable. Theiler, Bevan, Chambers and Smith, K. F. Meyer and Montgomery have made use of weakly virulent strains for producing immunity.

Immunization with "Incubation Virus"

Early in October of this year, the Bureau received a request from Dr. A. D. Knowles regarding a method for immunizing cattle in Florida against anaplasmosis and in response forwarded for his consideration a description of the Algerian investigator's "incubation-virus" procedure. In a short time Dr. Knowles began the production and use of the "incubation-virus" in a restricted district where the disease was known to exist. A report received from Dr. Knowles a few days ago (November 28, 1927) shows that nearly a thousand cattle have been treated. In the first herd treated, consisting of 90 head of young stock, a number of the animals began to show reactions on the twelfth day following inoculation, but recovered in about three days, although they appeared to have lost some flesh. No elevation of temperature was noted. In another herd of adult cattle, more severe reactions developed in a considerable number of animals on the twenty-first day and some losses were sustained later. In the rest of the cattle treated, while no serious accidents are reported, it is probably too early to judge the final outcome of the inoculations. In the meantime it seems to be the wisest plan to suspend further immunization until such time as the present tests can be adequately evaluated.

Acknowledgments

In conclusion, I should like to make due acknowledgments to the following men who have made possible and greatly aided

in the investigation of this Florida cattle disease: Dr. J. S. Buckley, Chief, Pathological Division; Dr. A. D. Knowles, Dr. V. M. Jared and Hon. H. S. Pennock, of Florida; and to Dr. T. H. Applewhite and Dr. J. H. Yoder, of the Tick Eradication Division, and Dr. J. G. Fish and Dr. J. R. Love, of the Tuberculosis Eradication Division.

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PRESIDENT VAN ES: Dr. George W. Stiles, of the Bureau of Animal Industry, will now discuss this paper.

DR. STILES: I have just a brief paper, prepared without the knowledge of the contents of Dr. Giltner's paper. I did not have access to the extensive literature that the Doctor had, and rather than give you a fragmentary discussion of his paper, not having had it at hand prior to coming to this meeting, I deem it advisable to give you just a brief summary of the work done in Kansas and Oklahoma.

A digest of questionnaires sent to practitioners in Kansas and Oklahoma shows the following:

In Kansas, anaplasmosis is reported present this year in 22 of the 87 counties, as follows: Allen, Anderson, Bourbon, Butler, Chautauqua, Cowley, Crawford, Douglass, Elk, Franklin, Greenwood, Harper, Harvey, Jefferson, Labette, Leavenworth, Montgomery, Neosho, Osage, Reno, Riley, Sedgwick, Sumner, and Wilson. Of the seventy-one reports received from practicing veterinarians, seventeen report 324 cases, with 128 deaths, or about 39 per cent mortality.

In Oklahoma, anaplasmosis is reported present in 22 of the 77 counties, as follows: Alfalfa, Blaine, Cherokee, Craig, Garfield, Kay, Kingfisher, Logan, Mayes, Nobel, Nowata, Oklahoma, Okmulgee, Osage, Ottawa, Pawnee, Payne, Pittsburg, Pottawatomie, Rogers, Tulsa and Washington. Of the thirty-two reports received from practitioners, twelve report 114 deaths and 303 cases, or a mortality of 26 per cent. Averaging the loss in Kansas, the general mortality is about 30 per cent, which in either state is necessarily incomplete and therefore inaccurate. One veterinarian, who reports the largest number of cases treated, estimates he was called to about one-third of the cases actually present in his district. Questionnaires sent to veterinarians of Colorado and New Mexico fail thus far to disclose any positive cases in these two states, although but very few reports from either state have been received. I spent the month of October in Oklahoma and Kansas, making an epidemiological investigation of this disease.

The following animal inoculations have been made: (a) A yearling Jersey bull received 20 cc of defibrinated blood from a freshly dead cow, subcutaneously in the neck, on October 7, 1927. Prior to inoculation, the bull's blood failed to show any parasites present; temperature, 102° F. and the animal appeared normal in every respect. Fifteen days later, a few parasites were visible in the blood, but no symptoms of illness were evident. On November 1, twenty-four days later, this animal's temperature was 105.8° F. an increase in the apparent number of parasites was observed but no icterus was noted. Later observations (Nov. 23, 1927) indicate there is little change in this animal.

(b) Two rabbits were likewise injected, one with 2 cc of blood; the other, with fresh spleen emulsion of a cow. One month later, these animals show parasites present in the blood; the spleen case appears sickly, with a temperature of 103° F.

(c) Two white guinea pigs of average size each received 0.5 cc of defibrinated blood of an infected cow; one subcutaneously, the other intraperitoneally. Microscopic examinations ranging over six weeks show a few parasites present in the blood corpuscles, but temperatures remain about normal and their general appearance is little changed. Hemoblobin, 70 per cent. The above animals were furnished by the Oklahoma A. & M. College and the injections made at that place. The guinea pigs and rabbits were shipped to Denver for further observation, while the calf is still under surveillance at the College.

Possible means of transmission: (a) Ticks. Since anaplasmosis closely resembles Texas fever, it is usually considered tick-borne; however, this remains to be proven. Herms says there are over forty species of ticks in the United States. The evidence thus far obtained from questionnaires set to all registered veterinarians in Oklahoma, Kansas, Colorado and New Mexico, and to other individuals, indicates that no ticks of any kind except an occasional spinose or ear tick (*Ornithodorus magnini*) are found present on cattle suffering from anaplasmosis.

(b) Flies. According to Professor C. E. Sanborn, entomologist at the Oklahoma A. & M. College, there are a number of flies prevalent in Oklahoma which feed on and among cattle, and the evidence shows these insects were unusually severe this season. Three varieties of the large horse flies (Tabanidae), the horn (*Hematobia serrata*), stable (*Stomoxys calcitrans*), warble (*Hypoderma lineata*), screw worm (*Chrysomyia macellaria*), and other varieties were observed to be present in large numbers on cattle this year, causing much annoyance and economic loss from their ravages, aside from being possible carriers of *Anaplasma marginale* from afflicted to healthy cattle. We detected anaplasmosis parasites in undigested blood corpuscles in stable flies caught feeding on sick cattle. Flies were particularly severe in biting unprotected areas, often causing the blood to ooze around the umbilicus and the root of the tail in milk cows.

(c) Mosquitoes. Owing to the severe floods this season and the increased rainfall, favorable conditions were afforded the excessive multiplication of this insect. Professor Sanborn, after making a general survey of the northeastern section of Oklahoma and southeastern Kansas, informs me that he is impressed with the possibility of the mosquito being an active factor in spreading anaplasmosis.

Accompanied by Professor Sanborn and Dr. Harry W. Orr, of the Oklahoma A. & M. College, I spent considerable time in examining reptiles, wild animals and birds for possible tick infestation on farms where cattle were sick of anaplasmosis. Jack rabbits, cottontails, squirrels, land turtles, snakes, rats, crows, owls, blue jays and turtle doves were examined with negative results, so far as ticks known to infest cattle were concerned. A few rabbits harbored rabbit ticks (*Haemaphysalis leporis*). Thus it will be seen that much time and effort will be required to study the relationship of ticks, flies, mosquitoes or any other unrecognized insects or factors which might be responsible for the spread of this disease in cattle from one section of the country to another.

Carriers. There is increasing evidence among investigators of animal diseases that upon careful observation and study one often can find carriers in almost any species of fowl or animal which may be responsible for harboring a given disease, whether parasitic or bacterial. In this investigation it has been shown that convalescent cattle harbor the parasite for variable periods of time. Should such animals be shipped or moved from one locality to another they could become potential possibilities of spreading the disease through the medium of biting insects, provided subsequent investigations prove such agents are positive factors in this respect.

Treatment. Many veterinarians interviewed believe flushing of the bowels with saline purges are indicated; others consider this useless. The use of intravenous injections with very large doses of arsenical preparations, sold under various trade names, is considered advisable by most practitioners,

although some advocate the use of trypan-blue, salvarsan and two per cent mercurochrome. Stimulative treatment with strychnin and tonics to support the heart action, the use of blood parasiticides intravenously, the regulation of the gastro-intestinal trace, and good nursing are all indicated. Large quantities of saline solution introduced into the body subcutaneously, by the mouth or rectum, may be of value to support the embarassed circulatory system, and remove the toxic substances elaborated by the parasites. Medicated mineral oils are used by some veterinarians to regulate the gastro-intestinal tract. Quinin may be of value, but is considered prohibitive in price.

Owing to the possible presence of hemorrhagic septicemia in herds also infested with anaplasmosis, the use of bacterins, serums or aggressins made for hemorrhagic septicemia might be indicated and of value in such herds. It is probable that transfusion of normal defibrinated cow's blood from a donor to an infected animal would be of value in restoring such animals, provided the treatment was not too expensive. Cattle on ranges may die before the disease is noted; hence, the opportunity to treat such cases or control the malady is difficult.

Theoretically, the ideal method of treatment is prevention. When the causative agent which carries the protozoon is discovered, then more satisfactory measures can probably be adopted to control or eliminate the disease.

DR. IVERSON: It may be well to add that during the past summer veterinarians of the State Division found conclusive evidence of the existence of this condition in several other sections of California.

Reference was made by Dr. Giltner to the discovery in Contra Costa County. We found that in three or four other counties, and in several places where the disease was found, there was no evidence of ticks of any kind.

DR. H. SCHMIDT: I was very much interested in this paper on anaplasmosis by Dr. Giltner. I think he has presented a very admirable paper. He has certainly given us a splendid review of the literature on the subject.

I come from the heart of the Texas-fever district, and naturally I have had a keen interest in this disease as long as I have been there. There are just a few remarks I wish to make on the immunization of cattle against Texas fever, as we call it, and, incidentally, anaplasma or anaplasmosis. We have long recognized in Texas that we have a mixed infection of *Piroplasma bigeminum* and *Anaplasma marginale*.

We were glad indeed when they shipped a load of cows to Germany from Texas, the authorities in Germany saw fit to carry on some experiments along this line, because they were in a position to be away from the Texas fever tick, as we have it, and make some accurate observations. Helm has definitely shown that we have a mixed infection in our Texas cattle. He was able to show that the *Ixodes ricinus* would transmit *Anaplasma marginale* but would not transmit *Piroplasma bigeminum*.

In our work with Texas fever, we have naturally done a large number of immunizations. If it had not been for that, I think most of the cattle south of the quarantine line would be wearing long horns. It would not have been possible for us to improve our stock, that is the range stock of cattle. We have come to accept only certain animals for inoculations. The owner usually writes in and wants to know what kind of an animal to buy. He wants to get a pure-bred animal from above the quarantine line in order to improve his herd. We invariably tell him we do not want him to buy an animal over fifteen months old. We have frequently tried to inoculate and immunize animals older than that, but have been stumped so often, we have quit it entirely. We have had some two- and three-year-olds sent down against our objections, and the buyer has invariably had to foot the bill.

In these inoculations we find two typical reactions and two different kinds of bugs. We find that sometimes as early as the third day and sometimes as late as the tenth day we get what we call a primary reaction. When we examined the blood from the animals microscopically, we find the *Piroplasma bigeminum*. We take the temperature record of the animals every day, and we find, about the seventeenth day in some animals, we get another reaction, but more frequently we get the secondary reaction around about the thirtieth day, twenty-eighth or twenty-ninth day, thirty-second day, and as late as

the forty-sixth day. If we examine the blood carefully on these occasions, we find the *Anaplasma marginale*. I think it is very inadvisable to try to inoculate; if you want to start immunization, try to immunize an old animal, either against the *Anaplasma marginale* or *Piroplasma bigeminum*. Our losses from the one are almost as large as the other. I have no exact figures with me. I did not think I would be called upon to express our views on this subject, but the problem of immunization was brought up, and I think it is rather an important thing to know some of the pioneer work that was done in this country along that line. (Applause)

DR. CONNAWAY: I believe Dr. McNeil might tell us something about the Brazilian trouble. I recall years ago when Dr. Francis, of the Texas Station, and I, at the Missouri Station, were experimenting on cattle inoculation. Through the offices of Dr. Francis, some Texas cattle were shipped to Brazil and died from a fever that looked like Texas fever, and Dr. McNeil sent me some of the ticks. The ticks of that country, you know, are a little different from our ticks. The male tick has a little spike on his posterior end, that the male tick of our Texas fever does not have. He had the notion that the symptoms were those of our American Texas fever.

DR. D. M. CAMPBELL: I would like to make just a brief statement about the treatment of anaplasmosis. This disease under the name of tickless tick fever has been reported occasionally down in southeastern Kansas for some years, maybe six or eight, and the treatment usually resorted to, as Dr. Stiles pointed out, has been the arsenical preparations, given sometimes intravenously and orally. I do not think the essayist mentioned the administration of arsenic per os. The results of the treatment have been variable; sometimes good, at other times not so good. The use of arsenic has come to be the accepted treatment over that section of the country for anaplasmosis.

This year there has been more of this disease than previously; its prevalence has in fact caused considerable concern. One instance I think is of some interest. This disease appeared in a herd of pure-bred cattle of the beef type, consisting of something more than 300 animals kept under range or semi-range conditions. The disease was an acute type and several animals had died. The attending veterinarian administered the arsenical treatment, giving sodium cacodylate intravenously in 30-grain doses; treating only the sick ones brought in by range-riders. There was no apparent benefit from the treatment and the animals continued to sicken on the range and when brought into the home corrals and treated, they continued to die.

A consultant was called. At that time there was a dead animal on the place that was autopsied. Another was moribund and it was killed and autopsied also. The disease was diagnosed clinically and later by laboratory examination, so there can be no question about the diagnosis. The arsenic treatment was continued but the dose was increased to 120 grains, intravenously, to animals weighing 1400 pounds. The veterinarians went out on the range and found, I believe, eight more animals that showed temperatures ranging between 105 and 106° F., an exceedingly uniform temperature for sick animals. They were given the same treatment, 120 grains of sodium cacodylate. All recovered. In a few days some more had come down and were given the same treatment and recovered. But the owner at this time insisted that the remainder of the herd be treated also. This was carried out, although obviously it was a large order to fill. Giving an intravenous injection to 300 half-wild range cattle that can be caught only by roping from a horse is not play, by any means.

The well animals of 1400 lbs. weight were given 80 grains each of sodium cacodylate intravenously, others were given a proportionate dose for their sizes. There was no further extension of the disease. No further loss after all animals in the herd, sick and well, were treated.

Now, here is the point in this matter that I think is important. The outcome of a given treatment in a single instance is ordinarily of small moment, and it would be here, were it not for the fact that it is in line with the results that have been obtained over several years.

The results in this herd, which was certainly a large one to be subjected to intravenous administration, were in line with what has, in the past, too commonly followed the same treatment, that is no benefit. But, in the same herd and the same outbreak where these unsatisfactory results had been obtained from the usual treatment, quadrupling the dose of arsenic brought astonishingly satisfactory results; certainly so far as the treatment was concerned, and a dose only a little less massive appeared successful as a preventive of anaplasmosis, although, of course, we cannot be sure that there would have been a further extension of the disease even without the prophylactic treatment.

I presume most of us would consider 120 grains of sodium cacodylate intravenously as a dangerously large dose, but in this herd there were no untoward results that could be attributed to it. The treatment appears to be less dangerous and the outcome more satisfactory than the biologic treatment used in the recent Florida outbreak, if we may judge the latter from its use on approximately twice this number of animals.

PRESIDENT VAN ES: If there is no further discussion, I will entertain a motion to adjourn.

. . . A motion for adjournment was made, seconded and carried. The meeting adjourned at 12:30 p. m. . . .

FRIDAY AFTERNOON, DECEMBER 2, 1927

The sixth session convened at 1:40 p. m., President Van Es presiding.

PRESIDENT VAN ES: The first paper on the program this afternoon is entitled, "What Tick Eradication is Doing for the Cattle Industry in Florida," by Dr. J. V. Knapp, State Veterinarian of Florida. (Applause)

WHAT TICK ERADICATION IS DOING FOR THE CATTLE INDUSTRY IN FLORIDA

By J. V. KNAPP, *Tallahassee, Fla.*

State Veterinarian

I am here under considerable handicap in view, first, of the audience, and, secondly, in that the Committee who prepared this part of the program intended to have the chairman of the Florida Live Stock Sanitary Board here to present this portion, or talk on this subject. Therefore, I am substituting, in a manner, for that particular man and for Florida, and feel that I should, in a way, try to give you his slant or his view of the question of tick eradication and the cattle improvement in Florida.

Prior to 1923, very little was done in the state of Florida relative to tick eradication, and that was the time when the present State Live Stock Sanitary Board came into existence. We now have ideas of progression, and we have sufficient funds at hand to operate. Therefore, the members of this Board of whom I speak, on taking their official position, attempted to take stock.

As you all know, Florida was the state in the Union into which cattle were introduced from the old country. Therefore,

it would follow that we should have the most highly developed cattle industry in the continental United States. However, the exact opposite is true. We have probably the poorest development, and some of the scrubbiest cattle of any state in the Union. There is but one answer to that, and that is the fact that we have the cattle fever tick to a large extent affecting our cattle.

The position of the Board, in reviewing this matter, might well be illustrated by this story, as pertains to the attitude of the people of Florida, and possibly some of the other sections of the southeastern states, toward tick eradication. This story is told by Bishop Langley, who recently attended a meeting of the ecclesiastics in New Orleans. Going down the street with a friend, he said, "John, do you see that man across the street?"

His friend said, "Yes, Bishop."

He said, "Well, he is a pale gray ass."

"What?"

"I said, 'He is a pale gray ass.' "

"What do you mean by a pale gray ass?"

He said, "Well, a pale gray ass is an ass that has been an ass a long, long time." (Laughter)

The people of Florida, being the importers of cattle, took no real cognizance of the fact they were the poorest cattle in the United States, or that they needed any attention from a live stock sanitary standpoint, until probably twenty years after the initial steps in tick eradication were taken by other states. That is a long, long time. We are attempting to make up for our dilatory methods, and the lack of someone to take hold of that work and push it, by doing our best to complete tick eradication in the United States, not last but while there are some tick-infested areas in the other states.

As tick eradication affects the live stock industry in Florida, particularly the cattle industry, I will say that in 1915, before any state law, or state appropriation, was available for the cooperative work with the federal government in this respect, work was undertaken through the instrumentality of the Board of County Commissioners and the citizens of Dade and Broward counties, southeast Florida. At that time there were probably less that 800 head of cattle in that area, all dairy cattle, and they resembled our scrub cattle in every respect, except they were milked, and gave some milk. They were like the cattle

which I understand exist in some parts of South Carolina, where my friend Dr. Lewis abides.

I might illustrate the condition of those cattle by this little story. A preacher was out one day attempting to buy cattle, and came in contact with a cattle tradesman and informed him he wanted a milch cow for his family. The preacher, of course, not being much versed in dairy cattle, took a great deal for granted on the part of the cattle trader. After listening to the fact the animal would give between two and three gallons of milk, and was otherwise a very efficient animal and well bred, he got down on his knees and proceeded to look around at the animal and up at the udder.

At last he said, "It appears she ought to give cool milk, anyway."

The tradesman, probably never hearing of that, said, "Why?"

"Her udder is way up in the shade." (Laughter)

That is the type of dairy cattle we had in our section of Florida, in 1915 and before. Following the completion of tick eradication in the fall or winter of 1915, and its release from federal and state quarantine in 1916, that section of the State which, prior to that work, had less than 800 head of so-called cattle, now has something like 20,000 head of dairy cattle. There are many of them pure-bred, some of them hold national records of production. But that is a small matter, and affects only a few counties, in which the issue was forced, by reason of the fact we had a large demand for dairy products. That is largely our tourist section of Florida, and the demand for milk was phenomenal, and the prices received were the same, that is for the milk. Therefore, the dairy industry in that section grew rapidly. No further tick eradication work was conducted in the state of Florida until 1923, and very little in that year, because of lack of state appropriations, the same not becoming available until 1924.

In 1924 one zone was released from quarantine, or tick eradication was completed in that area, the same in 1926 and also in 1927. We found this situation to exist: Our efforts to eradicate the tick were meeting with success. Our efforts to increase our live stock industry, our cattle industry, by virtue of that fact, had not met with much response, the reason probably being that these people, for the past generations, not receiving much remuneration for their live stock, did not take much heart in what we told them relative to what they might do by

improving their stock by cross-breeding with pure-bred bulls. Therefore, the State Live Stock Sanitary Board, being required in its creation to foster the live stock industry, as well as protect it from communicable diseases, and things of that nature, decided they would put on a campaign in cooperation with the federal government to bring about an improvement of our cattle industry. They based their judgment on this fact: We have in Florida about 1,500,000 head of range cattle. Approximately 300,000 of those cattle, or their progeny, can go to market. Those cattle are worth three or four cents a pound live weight, and, incidentally, a great deal of that is hides, hoofs and horns, whereas, out of the 1,500,000 head of cattle we should be producing 300,000 head that, on the present market, or even a market for the past year, should sell somewhere in the neighborhood of eight to twelve cents a pound.

Our deductions went further. We looked over the United States to determine, if possible, why Florida cattle were so much depreciated in the market, and, consequently, revert back to the man who was raising them. We found this to exist: Texas, the largest state in the Union, has something over 6,000,000 head of cattle, as against Iowa, twenty-fourth state in area in the United States, having something over 4,000,000 head of cattle. The deduction to be drawn is this: Texas, with a little over 6,000,000 head of cattle, showed a cattle population per square mile of something like 23 head. Iowa, the twenty-fourth state in area, and with something over 4,000,000 head of cattle, showed a cattle population of 78 head per square mile.

The market value of the 4,000,000 head of cattle in Iowa was approximately the same as the 6,000,000 head of cattle in the state of Texas. I am using only references to the states of Texas and Iowa to bring out a point, with no reference whatever to the states themselves. Texas, as in the case of Florida, is largely an open-range state. Texas has an area nearly as large as the state of Florida, which is tick-infested. Iowa, on the other hand, is a tick-free area. That, however, in itself did not get us anywhere, because the Texas cattle were not selling on the market at any great premium, especially from the tick-infested area of Texas, over the Florida cattle.

Therefore, we carried our deductions a little further and found that, in all probability, the underlying cause of the better cattle in the tick-free area was due to the fact that it was a

highly developed agricultural section as against an open-range section. In other words, there was a definite and predetermined amount of winter food available, or that could be made available, to cattle, and that was the determining factor in the number of cattle and the value of cattle in different states; it being impossible in Florida to change radically, within the present generation, the agricultural development of that area, we had to look to some other means, obviously, to increase the valuation of our live stock industry. That is, it is much easier to change the educational phases, relations and the political education of a people, or its government, than it is to change its agricultural development overnight or over a period of a comparatively few years. It takes hundreds of years to develop a state agriculturally, whereas we can get out and educate people to the necessity of tick eradication in a few years. That is the point I am trying to make.

Therefore, not being able, with the advent of tick eradication, also to put under cultivation large areas in the state of Florida, which would produce winter feed for cattle, we decided that something else was necessary, and that tick eradication in itself was not solving the question of improving the live stock industry of Florida. On the other hand, in the areas where we worked, we had of necessity, by force and because better prices were offered for cattle in the areas where tick eradication was in process, depopulated those areas of probably one-half of the cattle. That meant we had really injured the cattle industry, rather than helped it, so far as it was concerned numerically, or as it would produce within the next several generations, pertaining to tick eradication.

We have determined on a plan as a result of tick eradication and are carrying it on as forcefully and as energetically as tick eradication can be, and that is in each county where we conduct tick eradication, we also conduct a simultaneous campaign of live stock improvement, educational, however, at that period. We tried to tell these people with whom we came in contact every fourteen days, for a period of a year or eighteen months, that it was necessary to place Florida on the map in the live stock industry—to improve their cattle.

It is obvious, then, that not having the winter feed to carry these cattle over and fatten them, either as one-year-olds or up, we must dispose of these animals before they have a chance to flood our range, beyond the point of 21 or 22 head per square

mile, because that is all that the Florida range will support. Therefore, we tell these people that what they should raise is calves, marketable in the fall, late fall or early winter. In our campaign, and with the bulls we have placed in several counties following this campaign, we have found that we can produce calves, pure-bred Herefords or Angus on native range cows that will weigh 400 to 475 pounds, dropped in February, and marketed in November. They will weigh more than the average Florida steer crossing the scales today. It is not so bad in theory if we can produce, from our native Florida cows, calves that will market in six or eight months from the time of their birth, at a weight more than a three-year-old steer. We believe it is practical. We believe that we can increase the market value of our cattle industry in Florida fully 100 per cent through the medium of tick eradication, which will of itself permit the introduction of pure-bred bulls, then the calves from the native cows crossed with the pure-bred bulls, selling in the fall or winter—an increased value of 100 per cent, first, in the weight and amount paid per pound for the calves, over the steers or other range cattle that we have there salable; secondly, that we can increase the number of our range or breeding stock. We can double that by virtue of the fact that if we dispose of the calf crop they will not be on the winter range, which is the determining factor of the number of cattle we can raise in Florida, 21 or 22 head being the limit per square mile.

If we have that number of cows on the range in the square mile (and the same applies to the State) and sell the calves before winter, we can maintain that average, whereas if we kept them, those of you who have been there, or in other sections of the Southeast, know the majority of them die down to about that point. So we are endeavoring to build a live stock industry in Florida, based on that principle, and we are receiving much help from the Bureau. We are receiving gratifying cooperation on the part of the cattlemen. We brought some gentlemen from Florida to Tennessee, with the idea of buying one or possibly two animals. When they saw them they bought six and eight, some to dispose of to their neighbors and some to look at. It is something that is receiving marked consideration on the part of our cattlemen, especially when they have the opportunity to sell a few of these calves. It is the dollars in their pockets that determine what they will do.

We have this advantage over other agencies, perhaps, in introducing this live stock. The work of tick eradication brings us in contact with each and every cattle-owner in a given area every fourteen days for a period of at least two years. We form, during that period of time, an entree to that man's home. We are able to talk business with him as no outsider can talk with him, because if he fails to dip his cattle, we dip them for him. Then we charge him real honest money for that service. We have established a business relation with that cattleman, whether voluntary or involuntary on his part, it makes no difference, but he has come to believe that what we say is possibly true, and if we say it more than once, we are going to make it true anyway.

Perhaps not being acquainted with tick eradication in our state, you do not understand what I mean by that. If a man refuses or forgets to dips his cattle, the State does that service for him and charges money. That may be pleasing to him or it may not. In the majority of instances, it is not, but we have established a confidence in that man, whereby he will believe us, when we tell him that it is a good thing for him to buy a pure-bred bull. Founded on that confidence we are changing the character of the cattle industry in at least ten counties in the state of Florida today. We expect to carry that campaign throughout the State as tick eradication progresses and is completed in the State.

PRESIDENT VAN ES: The next number on the program is "Completion of Tick Eradication in the Old Dominion State," by Dr. S. H. Still, of Virginia. (Applause)

DR. STILL: Before reading this paper, I would like to state that completing the work of tick eradication in any state has so many factors to be discussed and taken into consideration, to prepare a paper covering them all, or even to discuss them, would take more time at a meeting of this kind than it would be wise to take.

In completing the work in any state, there is honor enough for all concerned. In this paper I will make special mention of some individuals, yet realizing that all men concerned deserve their part of the credit.

. . . Dr. Still then read his paper. . . .

COMPLETION OF TICK ERADICATION IN THE OLD DOMINION STATE

By S. H. STILL, *Suffolk, Va.*

Inspector-in-Charge, Bureau of Animal Industry
U. S. Department of Agriculture

The grand old state of Virginia now enjoys the distinction of being one of the states not having a single county held under

Texas fever quarantine. On December 1, 1927, systematic tick eradication was completed in Virginia, and today only local areas are being held under local quarantine owing to the Texas fever tick.

The writer would like to state now that the statements that will be made with reference to state officials of Virginia, and to the work of tick eradication in that state, are not idle statements but are facts openly arrived at after due deliberation. And no statement to be regarded as self-praise for the writer, but I frankly confess that I am proud to have had the honor to be the Bureau representative, reporting to my superiors at Washington, closely associated with the work of completing tick eradication in Virginia.

The final drive on the tick began in Virginia within the past three years. During that time we have had our ups and downs, and have experienced various delays, and at times it seemed big obstacles stood in our way. The success in Virginia was brought about by adjusting our ups and downs, overcoming delays and removing obstacles. The larger percentages of the success was was due to the cooperation extended by the various state officials, this being carried on under the direct active leadership of Dr. H. C. Givens, State Veterinarian of Virginia.

Without going into details, the system under which the work was conducted in Virginia was the disinfection of all infested and exposed animals every fourteen days over a period of time sufficient in length to eradicate the tick, and at all times keeping every phase of the work under close supervision, never forgetting that the work of tick eradication is based upon a scientific fact.

Virginia was confronted with a condition in regard to tick eradication work, a few words about which might prove interesting and helpful to some of you. In some of the counties in the State there were very large swamps, one of which is the Dismal Swamp, said to be the largest in the world. In these swamps were real wild cattle that had been in them for years. There was no way of getting these cattle confined, in order that they could be disinfected. Every one of them carried a heavy tick infestation. Therefore, the method used to free these areas was to slaughter the cattle and patrol the area to keep it vacant for sufficient length of time for the area to become free. In some of the swamps, due to timbers, swamp growth and water, it was almost impossible even to slaughter the cattle. The slaughtering was carried on by means of expert marksmen with

high-powered rifles, using dogs that had been trained to trail cattle. This phase of the work is the most nerve-trying that it has ever been my lot to witness. This may seem to be drastic treatment but sometimes it takes drastic treatment to get results. The work of ridding the swamps of wild cattle was of such an unusual character that at various intervals the Associated Press supplied the daily papers with articles in regard to same.

The matter of state leadership is so important in the work of tick eradication that I am going to leave the state of Virginia for a moment and cross over into the Old Tarheel State. You see, I am privileged to work in two states. During systematic and final tick eradication work in the state of North Carolina, it has been my good fortune to observe state leadership as carried on by Dr. William Moore, State Veterinarian of North Carolina, and I am frank to state that the successful culmination of tick eradication in the State was due, in large measure, to his active leadership.

Now back to Virginia and conclude. Virginia has produced some very noted military characters. My friend and coworker, Dr. H. C. Givens, State Veterinarian, may never achieve the fame that some of these gentlemen did, but he can certainly point with pride to the fact that he was the general who led the State forces at the battle of Dismal Swamp, that brought systematic tick eradication to a successful close in Virginia, and I will ever remember with pleasure that I and the Bureau men under my supervision fought by his side in this battle.

PRESIDENT VAN ES: The next paper on the program is entitled, "Tick Eradication Methods Found Successful in Arkansas," by Dr. W. A. McDonald. (Applause)

. . . Dr. McDonald read his paper. . . .

TICK ERADICATION METHODS FOUND SUCCESSFUL IN ARKANSAS

By W. A. McDONALD, *Little Rock, Ark.*

Inspector-in-Charge, U. S. Bureau of Animal Industry

In discussing methods found successful in tick eradication in Arkansas before a meeting of sanitary officials and live stock men from so wide an area, many of whom no doubt feel that the question of tick eradication does not particularly interest them, the writer of this paper is somewhat at a loss as to just what might be included that would not only be of interest to this

meeting, but might also be instrumental in causing this organization to adopt some plan that would assist the remaining tick-infested states in completing the troublesome task of tick eradication at the earliest possible date. It is believed that there is but little, if anything, that I might add to what has already been brought out in the preceding papers as to the necessity and advantages of tick eradication. However, I will say that possibilities resulting from tick eradication are beginning to bear fruit in the area freed of ticks through the importation of pure-bred dairy cattle which are being imported from your states by carload lots, and as time goes on and the movement gains momentum, the demand for pure-bred cattle from your states undoubtedly will mean a profitable business for cattlemen who have a surplus of animals with which to supply this demand.

Originally the tick-eradication theory was based on the life cycle and peculiar characteristics of the fever tick, that is, if cattle, horses and mules were removed from a given area for a given time, ticks would be eliminated from that area by the starvation process. The same results would also be obtained through the disinfection of all animals in a given territory at regular intervals for the same time as is necessary for the starvation process, with some agent that would kill the ticks with which the animals might be infested. These original theories have proven true, as is demonstrated by the fact that all but 223 of the original 985 infested counties have been released from quarantine through the methods enforced by cooperation of the Bureau of Animal Industry and the live stock sanitary boards of respective states in which ticks were originally found.

Various methods of carrying out these theories in the respective states have been employed with varying degrees of success. Tick eradication in Arkansas is cooperatively carried on by the State Live Stock Sanitary Board and the Bureau of Animal Industry. From the beginning we have had two outstanding and troublesome problems with which to contend, namely, local or state finance, and the regular dipping of 100 per cent of the infested and exposed animals in areas in which the work is being conducted. However, we have been employing methods for the past three or four years that have practically overcome the question of being able to disinfect all animals in counties in which the work is being conducted. Our laws and regulations provide that when systematic tick eradication is to be inaugurated in a group of counties, that all cattle and infested or

exposed horses and mules shall be disinfected under supervision of authorized agents at fourteen-day intervals. Forces of local inspectors are assigned to supervise the dipping in each county, one vat-man and one range-rider being assigned to each twelve vats, an average of about 100 vats being used in each county. The vat-man supervises the dipping, makes inspections, keeps records, and paint-marks the cattle, so that they may be identified as having been dipped when inspected on ranges and in pastures. The law provides that it shall be the duty of range-riders or other peace officers to seize and dip all animals not dipped by owners on regular dipping-dates under supervision of inspectors, assessing a fee of from one to three dollars per head for such services. Following each dipping-date, range-riders ride out ranges and pastures, dipping all delinquents as shown by dipping records, and found on such inspections. Through this method the work is completed in one season's dipping, beginning March 1 and ending December 1. During the past three years, the work has been inaugurated in fifteen new counties and completed, and counties released from quarantine after one season's dipping. Quarantine lines are maintained between the infested and free area and all animals moving from the quarantined area to free area are required to be dipped at designated dipping stations, under supervision of a regular employe and certified for movement to free area only after having been dipped and inspected and found free from infestation.

While we feel that our present method has practically eliminated one of the troublesome phases before mentioned, we still are confronted with the financial problem. Up until the past four or five years, county courts in which the work was to be conducted were requested to appropriate funds for chemicals and local inspectors. However, due to financial conditions of many of the counties and local political difficulties met with, we found that this means of financing the work was very unsatisfactory and in the 1925 session of the state legislature a state-wide program was suggested whereby the State would appropriate all funds covering local expenditures, relieving the counties of appropriating funds for this purpose. This plan proved to be much more successful. However, the 1927 session of the legislature reduced the amount of the state appropriation on account of financial conditions of the State, resulting in our being unable to inaugurate the work in as much new territory as we had hoped to be able to do. The future progress of tick

eradication in Arkansas and the probable date the work will be completed depends almost wholly on state finances and our observation in Arkansas has been that the greatest stimulus to legislatures and others to provide funds for tick eradication are regulations that prevent movement of cattle from quarantined area. With the strong demand and prices owners are receiving for cattle, at the present time, regulations preventing the shipment of cattle from quarantined area, no doubt would result in a more liberal appropriation and a much earlier completion of tick eradication in Arkansas.

PRESIDENT VAN ES: The next in order is the report of the Committee on Tick Eradication. I will call on Dr. W. K. Lewis to give that report. (Applause)

. . . Dr. Lewis read the report. . . .

REPORT OF COMMITTEE ON TICK ERADICATION

DR. W. K. LEWIS, *Chairman*, Columbia, South Carolina

Dr. J. H. Bux, Little Rock Ark.
Dr. C. A. Cary, Auburn, Ala.
Dr. J. V. Knapp, Tallahassee, Fla.
Dr. N. F. Williams, Ft. Worth, Tex.
Dr. W. M. MacKellar, Washington, D. C.
Dr. E. P. Flower, Baton Rouge, La.
Dr. R. V. Rafnel, Jackson, Miss.
Mr. H. B. Cordell, Oklahoma City, Okla.

During the year drawing to a close, about the only out-of-the-ordinary occurrence in tick eradication was the condition brought about by the Mississippi flood. Several large sections in the quarantined area, particularly in Louisiana, were inundated and in a few Louisiana parishes it was reported that practically every domestic animal had been removed or drowned by the time the flood reached its crest.

All ticks infesting these flooded pastures and ranges were undoubtedly destroyed and those directing the work of tick eradication in Louisiana, supported by a number of progressive cattle-owners and other business interests, urged the advisability of taking advantage of this situation and accomplishing tick eradication in the flooded section by restocking with only tick-free animals.

An emergency appropriation was made available by the Secretary of Agriculture to assist in caring for this work, but due largely to the demoralized condition following the flood and the lack of interest on the part of the cattle-owners, only a small area made an effort to take this short cut in eliminating the fever tick. The parishes of West Baton Rouge, Assumption, and a part of Ascension, are the only sections in which the effort has been continued.

The Committee is reliably informed that an effort is being made to repeal or postpone the provisions of the Crisp Bill and thus continue, after May 1, 1928, the interstate shipment of ticky cattle for immediate slaughter. We have prepared a resolution opposing any change in this law and respectfully recommend its adoption.

In most of the area in which systematic tick eradication was conducted this season satisfactory headway was made. Two states, namely, Louisiana and Mississippi, continued to mark time in their tick-eradication activities, the first for the lack of an adequate law and an appropriation, and the second because of an inadequate state appropriation. In both of these states, as might be expected, ground was lost in this project.

The year's work by cooperating agencies made the following changes in the federal quarantined area advisable and these changes have been ordered by the Secretary of Agriculture in B. A. I. Order 307, effective on and after December 1, 1927:

"In Alabama, Escambia County is released from quarantine.

"In Arkansas, Garland, Montgomery, Polk, Saline and Sevier counties, the remainder of Jefferson and Pulaski counties, and a portion of Little River and Howard counties are released from quarantine.

"In Florida, Escambia and Santa Rosa counties, and the remainder of Okaloosa, Walton and Holmes counties are released from quarantine.

"In Louisiana, Morehouse Parish, formerly released, is requarantined.

"In South Carolina, Berkeley County, and the remainder of Charleston County, are released from quarantine.

"In Texas, Bandera, Bastrop, Colorado, Coryell, Fayette, Kendall, Nueces and Titus counties, and a portion of Matagorda County, are released from quarantine.

"In Virginia, Southampton County is released from quarantine."

During the year twelve counties were added to the list of released counties reported absolutely tick-free, making a total of 653 counties in the released area in which tick eradication is completed. The Bureau's annual statement of results to December 1, 1927, in this project is appended for the Association's records.

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Animal Industry
Washington, D. C.

Statement of Results—Tick Eradication—July 1, 1906, to December 1, 1927

States	Counties Quarantined		Counties Released to	Released Counties Tick-Free on					
	July 1 1906	Dec. 1 1927	Dec. 1 1927	Nov. 1 1922	Nov. 1 1923	Nov. 1 1924	Nov. 1 1925	Nov. 1 1926	Nov. 1 1927
Alabama	67	4	63	15	26	41	49	49	57
Arkansas	75	22	53	16	21	34	31	41	44
California	15	0	15	15	15	15	15	15	15
Florida	67	49	18	3	3	1	7	12	14
Georgia	158	0	158	101	119	138	149	151	153
Kentucky	2	0	2	2	2	2	2	2	2
Louisiana	64	43	21	3	3	4	4	11	4
Mississippi	82	23	59	37	47	54	47	47	46
Missouri	4	0	4	4	4	4	4	4	4
North Carolina	73	0	73	40	46	53	65	73	71
Oklahoma	61	4	57	35	47	49	52	55	54
South Carolina	46	0	46	29	35	36	40	40	44
Texas	198	80	118	44	49	56	69	72	77
Virginia	31	0	31	*	*	*	25	27	26
Tennessee	42	0	42	41	41	42	42	42	42
Totals	985	225	760	385	458	529	601	641	653

(*Inactive November 1, 1922, to November 1, 1924)

Areas RELEASED from Federal quarantine, December 1, 1927:

Alabama, one county.
Arkansas, 5 counties, remainder of 2 counties, and parts of 2 counties.
Florida, 2 counties, and remainder of 3 counties.
South Carolina, one county, and remainder of one county.
Texas, 8 counties, and part of one county.
Virginia, one county.

Area REQUARANTINED, December 1, 1927:

Louisiana, one parish.

As reported by your Committee last year, the passage of the Crisp Bill by Congress repealing the special provision in Section 6 of the 1884 law, relating to the interstate movement of tick-infested cattle, becomes effective May 1, 1928, in accordance with such regulations as the Secretary of Agriculture may prescribe.

This Committee having been informed that cattlemen from the quarantined areas of Texas will endeavor to have Congress repeal or postpone the effective date of the Crisp Bill, respectfully offer the following resolution:

WHEREAS, The Committee has been reliably informed that an effort is being made to repeal or postpone the effective date of that provision in the Crisp Bill which will prohibit, on and after May 1, 1928, the interstate shipment of tick-infested cattle for any purpose, therefore be it

Resolved, That the U. S. Live Stock Sanitary Association reiterates the opinion, which it has expressed by resolutions at a number of past meetings, that the interstate shipment of tick-infested or exposed cattle is dangerous and unfair to states that have eradicated the cattle tick and to other free areas and should therefore be prohibited; and be it further

Resolved, That this Association most emphatically urges against any change being made in the Crisp Bill.

DR. CARY: I move we accept the report of the Committee and also the resolution they present.

. . . The motion was regularly seconded, put to a vote and carried. . . .

DR. R. A. RAMSAY: I wish to call the attention of the audience to the fact that we have changed our tactics in regard to tick eradication very greatly in the last few years. We are getting down to where it is harder work. We ate off the sugar, and we have a lot of areas here and there in the states where there is no sugar.

When I used to get a piece of bread and butter with sugar on, I had to pump water, and when there was nothing left but the crust, the pump did not work so well. That is about the way we are on tick eradication, we are down to where we have the sugar licked off, and are getting down to the crust. It is a little harder work.

There is something in these papers to which I would like to call your attention. I do not know whether you understand it or not. In the early days, we used to arrest the people for not dipping their cattle. We continued to arrest them. It got a little monotonous, and was not very effectual. The attorneys and lawyers got so they could fight tick eradication work. The courts got tired of it, and we did not get along so well. Then we conceived the idea of not arresting and prosecuting the owners, but arresting the cattle, as was brought out in the papers. We dipped them; held them and fed them well, according to the requirements of the humane society, and saw that the cattle were well taken care of. If the owner did not call for them and pay the three dollars per head and all expenses, the cattle were sold and expenses were paid, and the balance went to the owner. We find it very much better to arrest the cattle than to arrest the people. That is done in nearly every state. Even Dr. Cary has started in on it, and he is getting along fine.

By the way, I must say Dr. Cary has some territory without any sugar on it. He has about three or four counties left, and there is no sugar left on there, and it is going to be a hard drag. All the states have been fixed that way. There is one state in which we can not arrest the cattle. We have been a little afraid to try it; it is the state of Texas. They carry very large herds there, and we do not want to get into the cattle business to the extent of herds of 5000 head—it is too expensive. In Texas we are still arresting the people. They are in the cattle business sufficiently so as to make it worth while, and they get along very well there.

I feel tick eradication is getting along very well. We probably have released more area than we have any year within the last two years, and there

is bound to be a few counties with a few ticks, those counties lying adjacent to the quarantine area. The ticks will not observe the dead-line; they will spread over. We are bound to have some of them. We have quite a large number of counties that are absolutely tick free. I am encouraged.

DR. IVERSON: I thought tick eradication was ancient history long ago. Of course, I conceived that idea from living on the West Coast, in California, where in 1907 the State passed a law providing for the seizure of all cattle that were tick-infested, and the dipping of the stock under federal and state supervision, if the owner refused to do so. While the western fever ticks may be less resistant to eradication than those in the southern states, I formed the opinion that this was ancient history, because we were declared free from fever ticks in 1915, about eight years after the work started.

I think the sum and substance of the whole thing is the authority that was given by the legislature to those men engaged in carrying out the work, to seize any cattle, dip them, charge the expenses of the operation against the the cattle, and if the owner refused to pay the bill, the sheriff sold enough of the cattle to settle, and gave the rest to the owner. I think that is the answer, although it is probable, gentlemen, that in some parts of the southern states there are difficulties, natural difficulties, possibly somewhat greater that we had in California. (Applause)

PRESIDENT VAN ES: Are there any further remarks? If not, then I will call for the next paper, "Are We Losing the War on Parasites of Live Stock?' by Dr. Maurice C. Hall, of Washington. (Applause)

. . . Dr. Hall read his paper. . . .

ARE WE LOSING THE WAR ON PARASITES OF LIVE STOCK?

By MAURICE C. HALL

Chief, Zoological Division
Bureau of Animal Industry, Washington, D. C.

The present reports from the various sectors where the live stock industry and the parasites of live stock are at war indicate rather definitely that the war is going against the live stock industry, and that the parasites are increasing their area of occupation and their inroads on live stock in the occupied territory. Only in a few sectors is the live stock industry making any headway against the parasites, and while we can find cause for satisfaction in these successes, it is more important at this time that we turn our attention to our live stock losses and a consideration of how they may be stopped. The Zoological Division has been engaged for some time in making a series of war maps showing the disposition and strength of enemy forces and compiling the casualties sustained by the live stock industry. From a consideration of those maps and the available data, the following statements of our gains and losses along the battle-front have been formulated:

GAINS

In the swine parasite area: On this front we have made one of our greatest and most spectacular gains. The weapon which

has been employed has been sanitation, and it has shown an efficiency far in excess of the weapons customarily used in war. It has been said that it takes a ton of lead or steel to kill a man in war, and this expression indicates how vast is the waste and how small the efficiency of the weapons employed. By contrast with these weapons of relatively low efficiency, the weapon of sanitation has proven almost 100 per cent efficient in destroying the enemy against which it was primarily directed—the swine ascarid. In addition it has checked and driven back such enemy forces as those of bacillary necrosis, mange and similar enemies which depend in large part on filth for support.

The area from which come the most encouraging reports along this front is the Middle West. Here is the area in which the first offensive employing the new weapon was launched against the enemy in 1919, and here our gains have been continuous along a front which widens every year. The first battle was at Bloomington, Illinois, and the territory taken at that time has been consolidated and held continuously ever since. From that base, offensives have been pushed out over the state of Illinois, and from there over a large part of the Middle West.

A technical report of the engagement at Bloomington has been compiled by Dr. H. B. Raffensperger and Mr. J. W. Connelly, who directed the attack along the plan of battle laid down by the late Dr. B. H. Ransom, and this report will presently be available in print. Their report shows the following: The use of sanitation as prescribed by the swine sanitation system resulted in preventing almost all, apparently 98 per cent at least, of the loss it was designed to prevent, i. e., losses from worm parasites and filth-borne diseases. The stockmen engaged in the Bloomington battle lose about 23.8 per cent of the pigs farrowed, the remainder being raised to market age, and less than 2 per cent of the loss sustained could be charged to a possible defect in the system of sanitation. Over the United States in general, where sanitation tactics are not employed, approximately 45 per cent of pigs farrowed are lost, according to information furnished by the Division of Animal Husbandry. The loss of 23.8 per cent of pigs farrowed under the sanitation system is chargeable almost entirely to hostile forces other than parasites and filth-borne diseases, these forces being poor breeding, poor feeding, poor management and poor judgment. The campaign against these forces must be pushed by the animal

husbandman and the veterinarian; it is not the parasitologist's war.

We are able, then, to report sweeping victories against certain swine parasites, notably ascarids, in the Middle West. It seems probable that these victories represent savings and gains already amounting to a million dollars a year, and that advances will be made in this sector each year until the parasite enemies of swine are held in check or driven back over this entire area. Meanwhile a unit consisting of Dr. E. M. Nighbert and Mr. J. W. Connelly has been assigned to the South, with headquarters at Moultrie, Georgia, and is opening a campaign in that area in order to ascertain the efficiency of sanitation in the control of swine parasites under different conditions, and where the parasite forces are augmented by the presence of the kidney worm, a source of great loss to live stock as a result of condemnation by meat inspectors of leaf lard, livers, kidneys and portions of loins trimmed because of these parasites. The early reports from this sector are very encouraging, and it is probable that a vigorous campaign against swine parasites in the South will be under way in a few years. Meanwhile, as we shall show, we have been losing the fight against kidney worms.

Outside of these sectors the swine parasite forces appear to be making headway in an insidious fashion, and very little is being done to check their attack. The adaptation of sanitation methods to conditions in the West Coast, Southwest, Rocky Mountain, and East sectors of this country has not been undertaken, and only in a few places in these areas is the system being used in accordance with the methods developed in the Middle West.

In the sheep parasite area: The most deadly enemy of the sheep industry is the stomach worm, *Haemonchus contortus*. Up to the present time, attempts to combat this enemy by embargo methods, such as pasture rotation, with a view to starving him out, have not been successful, and only by such poison attacks as the use of copper sulphate, nicotin, and similar things, have we made any headway. Over the Middle West, and as far south as Missouri in the west and Virginia in the east, it has been found possible to hold this enemy in check and even to wrest some territory from him by the routine use of these poisons, and it seems probable that such tactics will be found effective in the North and West generally.

In the South the conditions are somewhat different. There are special pasture problems and semitropical climatic conditions which favor the enemy. A field unit under the direction of Dr. Cooper Curtice is developing a line of tactics and strategy at McNeill, Mississippi, and the early reports from him indicate that more strenuous methods of attack will be necessary here than were necessary under Middle West conditions. The heavy stocking which would make the short dense pastures of the South profitable is very favorable to the enemy, and the indications are that only an intelligent, vigorous and sustained attack on parasites will bring victory to the stockman who raises sheep in the South, so far as much of its pasture conditions is concerned.

In the meat inspection area: The war on parasites waged by the Meat Inspection Division of the federal Bureau of Animal Industry is one of the most sustained and dependable campaigns which is being carried on against these enemies. The interruption of the advance of parasites which follows from the destruction of their forces by driving them into the tank with a "Condemned" label affixed to them, which is the fate of worm-infested portions of carcasses, is a very final thing. In this manner millions of hostile roundworms, tapeworms and flukes are removed yearly from the active and potential forces of the enemy.

Possibly the most effective phase of this destruction is that dealing with immature tapeworms, the bladderworms or cysticerci. These parasites must get back to their human or live stock hosts by being eaten. The inspection service precludes this completion of the life cycle by condemning and destroying the portions containing them. In the past twenty years there has been a noticeable diminution in the East of one of the dog tapeworms, *Taenia hydatigena* (*T. marginata*). This tapeworm has as its bladderworm the form known as *Cysticercus tenuicollis*, occurring in the livers, mesenteries and omenta of cattle, sheep and swine. While we have no statistical data from which to trace the growing scarcity of this parasite in the East, the only agency to which this scarcity could well be charged is the routine destruction of the parasite in its larval stage by the meat inspection service. Precise data are lacking as regards the human tapeworms, *Taenia solium* and *Taenia saginata*, with their bladderworms, *Cysticercus cellulosae* in swine and *C. bovis* in cattle, but a comparison of the apparent incidence of these para-

sites in this country and in other countries which have no comparable meat inspection service indicates that these enemies are being held in check by our meat inspection warfare.

Another enemy, the deadly trichina, is also being held in check by the meat inspection forces. In some countries this enemy is being attacked by the method of microscopic inspection of pork for trichinosis. In this country the method developed by the late Dr. B. H. Ransom is as follows: All pork products customarily eaten without cooking by the consumer must be processed by cooking, refrigeration or curing by methods experimentally shown to ensure the destruction of the trichinae. In addition, the public is constantly being reminded by warnings of various sorts that pork should never be eaten until thoroughly cooked. Experience elsewhere shows that trichina inspection does not always reveal the presence of trichinae, and while this method of control is making headway against trichinae, there are two objections to it. It gives a sense of security, not always warranted and sometimes resulting fatally for the person confiding in it; and it is very expensive. The tactics adopted in this country give protection where it is most needed, give warning against the dangerous practice of eating raw or undercooked pork, and cost the people of the United States very little. Trichina inspection would cost millions of dollars annually, and this money is saved under the present system.

On the field inspection front: The Field Inspection Division of the federal Bureau of Animal Industry, with the cooperation of various state forces, has held in check or driven back one of the most devastating armies of the enemy, the forces of mange or scabies. Sheep scab was at one time one of the greatest banes of the sheep industry, taking a heavy toll in wool, mutton and life. The systematic attack by dipping and quarantine has driven this enemy out of many states and held it in check in the others. Cattle scab has also been driven back and checked over large areas. At present we are engaged in guerilla warfare against the scattered and fugitive forces of these enemies.

In the tick eradication area: One of the most brilliant campaigns against the forces of parasites is the one carried out in a systematic drive since 1906 against the cattle fever tick. Based on the sound tactics and strategy developed by scientists in the Bureau of Animal Industry, the campaign has been pushed by the Tick Eradication Division of that bureau so successfully that the quarantine line originally extending from Virginia to

California is now drawn far south. The tick and the prioplasm causing Texas fever are being driven back in a warfare that promises to terminate in their extermination from this country in a comparatively few years.

The work of the Field Inspection Division, the Meat Inspection Division and the Tick Eradication Division illustrates what may be expected where forces approximating those necessary to combat the enemy are put in the field. It will be noted later that our failure to hold our ground against other parasite enemies is due to an inadequate combat force.

Losses

The gains reported in the foregoing constitute almost the total gains so far as definite progress of a systematic sort is concerned. Elsewhere the battle goes against the live stock owner rather generally. Some of the more striking advances of the enemy are reported below.

In the cattle parasite area: On this front the live stock forces present, for the most part, a state of inaction against the attacks of the parasite enemies. The Zoological Division has a field unit under the direction of Dr. Gerald Dikmans, at Jeanerette, Louisiana, but that unit is handicapped by our quite general lack of knowledge of enemy habits and forces which must be ascertained before a campaign along practical lines can be inaugurated. Among the enemy forces are the Anaplasma, a blood parasite causing a disease resembling Texas fever. The Bureau of Animal Industry is giving this parasite some attention in Florida, Louisiana and Oklahoma, but it has no protozoologist to detail to war on this enemy, and it has devolved on Kansas and California to initiate the attack at this time, the parasite being known to be present in all the states named, and undoubtedly being present in many other states. Recently the Pathological Division of the Bureau of Animal Industry has inaugurated an attack.

Another enemy which is making headway is the coccidium of cattle. Another is the ox warble force, consisting of two species, one long an occupant of this country, and the other apparently a new invader which is rapidly extending its range of occupied territory. The warbles are held responsible for about $50,000,000 damage annually, and although a systematic attack is being planned, contingent on the enlistment of forces and money for the campaign, almost nothing has been done up to this time to

recapture the invaded territory. Numerous worm species hold their territory undisturbed and take toll of cattle every year, these enemies including stomach worms of various sorts, intestinal worms, lungworms and liver flukes, the flukes receiving separate consideration later in this paper.

In the horse parasite area: Horses in general are subject to the attacks of many enemies. Gross infestation with worm parasites is the rule, and these worms apparently lower the working efficiency of our horse population very materially. Practically nothing is being done about this, although combat measures have been devised and a preliminary attack is being planned. The bots are very troublesome, and one of these, the nose bot fly, is rapidly extending its range of occupied territory. Its widening range can be traced in increased runaways and the increased use of fly nets and other devices to prevent runaways and other results of fright resulting from the attack of the adult fly.

In the poultry parasite area: The worm parasites of poultry appear to be causing greatly increased losses to the poultry industry. Roundworms are prevalent everywhere, and in the East tapeworms do much damage. Attacks by poison, such as by nicotin sulphate for roundworms and by kamala for tapeworms, are being more widely used every year and in time it may be that we shall be able to report that the enemy is being checked and driven out, but this does not appear to be the case at present. Meanwhile coccidia are taking a large toll every year, and blackhead has carried its colors to victory in several states and practically driven out the turkey industry.

In the Zoological Division, Dr. Cram has found a number of spirurids and capillarids highly pathogenic to the domesticated and game birds in which they occur, and these parasites have been quite generally overlooked by poultrymen and pathologists alike in this country. For the most part we are ignorant as to control methods by treatment or prophylaxis.

In the kidney worm area: The swine kidney worm was confined, not so many years ago, to the South. It is now working its way northward, and with the constant shipments of swine over our extensive transportation systems it promises to take over the entire United States as its domain. The one hopeful thing in the situation is the preliminary evidence indicating that the sanitation system being developed in the South may prove effective against the enemy.

In the nodular worm area: The nodular worm of sheep is another enemy that once was restricted to the South. It has now invaded the Middle West, and apparently has a foothold in the Far West. Its presence results, among other things, in sending to the tank as condemned material the intestines which would otherwise be serviceable as sausage casings. As a result we are now importing casings from other countries and even manufacturing artificial casings. The result is a serious aggregate loss to the live stock industry. Very little in the way of effective control for the ravages of this enemy has been developed or applied.

In the liver fluke area: Not so long ago liver flukes were confined to the Gulf Coast and its tributaries, and to the West Coast and its tributaries. A recent survey shows that this enemy has invaded the Rocky Mountain States, apparently from the West Coast, and is working its way north from the Gulf Coast. Our losses are heavy in terms of livers tanked by the meat inspection service as unfit for food, and in deaths of sheep, goats and calves. Aside from some experimental control in Oregon during the past year by the Oregon Agricultural Station, nothing has been done to check this enemy. To show the serious possibilities confronting us, it may be noted that in Europe the loss from this parasite was so serious during the past year that the ministries of agriculture for Germany, Hungary and Czechoslovakia have given notice that they will reimburse the farmer half the cost of the treatment for liver fluke infestation in their stock.

Comparative Gains and Losses

A consideration of the available reports from the various battle-fronts shows that we are driving out one protozoan enemy, the organism causing Texas fever, and one arthropod enemy, the cattle tick which carries Texas fever; that we are gaining ground on another group of arthropod enemies, the mange and scab mites; and that we are holding in check or driving back a few tapeworms, *Taenia hydatigena*, *T. solium*, and *T. saginata*, and two roundworms, the swine ascarid and trichina.

On the other hand, such protozoan parasites as the coccidia and the organism responsible for blackhead in turkeys are making almost undisturbed headway against us; and Anaplasma finds us unprepared to meet its threat; liver fluke is widening its range every year and taking a heavy toll from the live stock

industry; most of the tapeworms hold a wide occupied territory and we are without even the technical knowledge on which to lay an embargo of an effective sort around them; two roundworms, the swine kidney worm and the sheep nodular worm, are sweeping along with extensive gains at the expense of the live stock industry every year, while scores of such roundworms as the lungworms, hookworms, trichostrongyles, ascarids, filarids, spirurids and capillarids hold the field practically undisturbed; and insects, mites and ticks flourish with only local and minor setbacks.

How the Parasites Make War

The warfare conducted by the parasites is constant and unremitting. The individual parasite may be destroyed by the accident of unfavorable conditions of environment or weather, but the activity of the species is unremitting. Every day throughout the year egg-production continues, larval development goes forward whenever conditions make it possible, and at every opportunity new parasites get back to old hosts or spread to new ones. Their preferred victims are young animals, and in these young ones we find the most parasites as a rule and the greatest damage. It is probably conservative to say that not less than 10 per cent of our young live stock perishes each year as a result of parasitism.

The attack of the parasites is insidious as a rule. Parasitism tends to take a long course, it does not run up the red flag of fever to announce its presence as do the bacterial diseases, and the relatively slow development of unthriftiness usually leads the stockman to condemn the animal as a poor specimen more than it inclines him to suspect that disease is present. If a wolf or a sheep-killing dog gets into the flock and destroys two or three sheep, the sheepman rises immediately to a realization of loss and a demand for control; if blackleg destroys a half-dozen calves, the cattleman promptly seeks aid; but parasites take their heavy annual toll of hundreds of millions of dollars, working stealthily out of sight and without such advertisement of their presence as would be afforded by quick deaths and febrile conditions, and the stockman looks on more or less philosophically or regards it as merely his hard luck.

How Should We Make War?

If we are to combat successfully our numerous parasite enemies we must put in the field an adequate force of trained

combat troops. A famous Confederate once said that the whole art of war was "to git thar fustest with the mostest men." Napoleon's dictum that God is on the side of the man with the most artillery is in effect the same thought. We cannot win the war on parasites with inadequate forces, and the present forces are hopelessly inadequate. No financial or scientific wizardry can make one dollar protect one hundred thousand dollars worth of live stock from parasites for one year.

A consideration of the forces available for war on parasites shows the following: There are certain federal, state and individual forces engaged all or part of the time in this warfare. These forces comprise the federal Bureau of Animal Industry and the federal Bureau of Entomology; the state veterinarians, animal husbandmen and entomologists; the staffs of the state agricultural colleges and experiment stations and the county agents and extension forces; and the practicing veterinarians and the stockmen.

In the federal Bureau of Animal Industry we have the forces, already mentioned, of the Meat Inspection, Field Inspection and Tick Eradication divisions, constantly in the field and carrying on an efficient organized warfare on parasites which is making steady gains against the enemy. These forces could very well be enlarged in personnel and scope and coordinated with other agencies to increase their importance in driving back parasites. In all probability a 10 per cent increase in personnel would result in much more than 10 per cent increase in accomplishment in this direction.

Also in the federal Bureau of Animal Industry we have the Zoological Division, devoted entirely to the warfare on ive stock parasites in general. As organized at present, this division has six technical workers at the Washington laboratory, and six technical employes in the field. Of the six technical workers at Washington, only three are available for the basic investigations on taxonomy, morphology and life history of our parasite enemies which must serve as the foundation for control measures. As a practical proposition, the life history investigations on which prophylactic measures must be based may be combined with a certain amount of purely technical, morphological and classification work to fill the intervals in experimental procedures. However, the workers in question are doing the systematic work for the Bureau, for other offices of the Department of Agriculture, and for various individuals in the states, and the

identification of the hundreds of specimens sent in makes so great a demand on their time that there is too little opportunity to initiate and carry out life history studies.

The lack of an adequate staff of investigators at Washington is a serious weakness in any organized campaign against live stock parasites in the United States. Washington affords exceptional facilities for carrying out the basic scientific research on which practical field control measures must be based. There are in that city the libraries, laboratory facilities, catalogues, indices and other equipment which are usually more or less unavailable to the isolated worker elsewhere. There are the stimulation and benefit afforded by other workers in the same subject. There is also the machinery of the Bureau for collecting and coordinating information. For these reasons the Washington staff should be in a position to render to the field forces of the Department of Agriculture, to the states and the colleges, and to individual workers, the service of identifying specimens and supplying technical information obtained from the world's literature and from the Division's own research. At the present time the burden of systematic work of identification is too heavy to permit of sufficient attention to obtaining technical information by research, and an enlarged staff is necessary to permit of a readjustment of these two items. The Zoological Division has long held the position as headquarters for the army engaged in the warfare on parasites of live stock in the United States, and should continue to function as a leading source of technical information. It can do so efficiently only by an enlargement of its forces to meet the attacks of a persistent enemy which must be taken seriously if the live stock industry is to obtain relief from that enemy.

The field forces of the Zoological Division are engaged with swine parasites in Georgia and Illinois, sheep parasites in Mississippi, cattle parasites in Louisiana, poultry parasites in Maryland and external parasites in Kansas. Most of the work of the Middle West and East has been transferred to the South to meet emergency conditions, and no work has been done in the Rocky Mountain States, on the West Coast, or in the Southwest. Forces are needed for the latter areas.

In the federal Bureau of Entomology there are two divisions working for the aid of the stockman, a taxonomic unit handling the systematic work of identification, classification and morphology, and a unit on insects parasitic on man and animals

handling the life history and basic phases of control work. These units are engaged in the work of identification of specimens, the ascertaining of life histories, and the development of control measures for the war on insect parasites of live stock. For many phases of the work on insect parasites the federal Bureau of Entomology is and should be a headquarters unit, serving the individual workers in the states and directing campaigns.

The principal efforts of the federal forces must be directed towards the supplying of technical information to its field forces and workers in the various states, and towards the control of parasites having rather wide distribution. The work of control of localized parasites and the application of control measures after these are ascertained for widespread parasites must devolve largely on state men, practicing veterinarians and others. Some states have done excellent research on their local parasite problems, their research including the excellent work in Oregon on the salmon fluke as a pathogen for dogs, and in Florida on the life history of the eye worm of chickens. Some states have an admirable record in the eradication of certain parasites within their borders, an illustration being that of Montana, where efficient state veterinarians, past and present, have driven out the pest of sheep scab and kept it out. More men are needed for this phase of the warfare on parasites. Each state has local conditions which must be understood before control measures for parasites can be effectively put in operation. Certain phases of treatment must fall to the practicing veterinarian, certain educational measures to the animal husbandman, the entomologist, and the county agent, and the methods of sanitation and other control measures must be understood and practiced by the stockman.

There is, then, need for larger forces and much better coordination and cooperation among the forces engaged in the war on parasites if the live stock industry is to be freed from the harassing attacks of these enemies. A larger federal research unit is needed to develop and supply the technical information in regard to enemy strength and habits and in regard to suitable tactics and strategy for the defeat of the enemy. Increased federal and state forces are needed to put into effect the combat measures developed in the laboratory. Increased cooperation is needed to educate the stockman in regard to his losses and the means for preventing them. The war is going against us, but

for the most part it is not realized that we are at war. It is time to recruit and train our forces and to take the field in sufficient strength to check and drive back the enemies which take from mankind the meat we should eat, the wool which should clothe us, and the leather with which we should be shod. Delay is expensive and there has been enough delay. The answer to the question in the title of this paper, "Are we losing the war on parasites of live stock?" is: *Yes! We are!*

PRESIDENT VAN ES: The next in order is the report of the Committee on Parasitic Diseases. Dr. W. J. Butler.

. . . Dr. Butler read the report. . . .

REPORT OF THE COMMITTEE ON PARASITIC DISEASES

DR. W. J. BUTLER, *Chairman*, Helena, Mont.

Dr. M. C. Hall, Washington, D. C. Dr. C. G. Lamb, Denver, Colo.

In the struggle for existence primitive man had to contend with the wild animals and reptiles of the forests and jungles. He conquered these enemies of human and animal life with mechanical weapons of his own ingenuity and making. Then he embraced the art of stock-growing. He domesticated animals of different species as a food supply and as beasts of burden. To have these animals under his constant control, he built fences to inclose pastures and congregated his animals within pastures and stables. Then, to provide the human family as well as the domesticated animals with farinaceous foods, he plowed the virgin soil and opened up Mother Earth to bacterial and parasitic invasion.

In the beginning his fight was against predatory animals and reptiles. Today his fight for existence, due largely to the concentration of a social animal under conditions of domestication and civilization, is against insect life and the various parasites. Let no one be deceived! It is a fight to the finish. Insects and parasites will conquer man, or man will conquer them.

Always it has been and always it will be "the survival of the fittest." This applies to parasites as well as to man and to man's fight against parasites. Parasites must have hosts in which to live and propagate. Nature has failed to provide many of our most insidious parasites with any perceptible means of locomotion. To overcome this adisdvantage, some of these parasites first parasitize some insect or tick or mite which has means of locomotion, and by means of this vehicle they are carried and gain entrance into the animal's body, a step which is necessary for their propagation. Thus we have "parasites within parasites," super-parasites, as it were, carrying lesser parasites virulent to animal life. Probably it may not be amiss to call a few such cases to your mind. Mosquitoes carry the causative organisms of yellow fever and malaria. The tick, *Dermacentor andersoni*, carries the Rickettsia of spotted fever and *Bacterium tularense* of tularemia. The flea carries the causative agency of bubonic fever, the rat carrying the flea from place to place. The tick, *Boophilus annulatus*, carries and transmits the agency of Texas fever. To add to our troubles in our fight against parasitism, we have greater parasites which, though visible to the naked eye, we are not as yet controlling, and in many instances we have not even unraveled their intricate life cycle. Most of these depend on an enormous output of eggs and the law of chance for their spread. It is with these parasites that this committee is more directly concerned.

In live stock we find many parasites which do not necessarily cause death, but which cause untold economic loss. We have the ox warble flies, which alone causes an annual loss estimated at fifty million dollars, the nose fly of

sheep, the bot flies of horses, other flies, mites, roundworms, tape worms, flatworms, and so on *ad infinitum*. We are not alone in this fight—the agriculturist has the corn borer, the boll weevil, the Hessian fly and so on, also practically *ad infinitum*.

Is man losing his fight against parasites of live stock? This question will be answered in a paper by Dr. Maurice C. Hall, which paper will also contain statistical information which will not be duplicated in this report. Will man continue to lose his fight against parasites? To that question we answer, "No!" What Gorgas accomplished in his fight against the mosquito and yellow fever in Panama can be duplicated by man in his fight against other parasites. But let us not deceive ourselves. It will be a long and bitter campaign involving the employment of man's ingenuity together with an adequate outlay of funds and the cooperative and concerted investigation of veterinarians, medical men, entomologists, bacteriologists and zoologists.

If one parasite, the ox warble, causes an estimated loss of 50 million dollars a year, what is the total loss from all parasites? One guess is as good as another but whatever the figure may be, we are assured that it is at least hundreds of millions of dollars a year, a preventable loss that is increasing by leaps and bounds while the world sits idly by. Action is needed and drastic action.

Your present committee endorses and approves the recommendations made by the Committee on Parasitic Diseases at the last annual meeting of this Association. We also recommend that the Committee on Parasitic Diseases make a close study of the spread of parasites by our modern transportation facilities, in addition to gathering and correlating, from the various states, statistical information on parasites.

DR. BUTLER: Mr. Chairman, I move the adoption of that report.

. . . The motion was regularly seconded and carried. . . .

PRESIDENT VAN ES: Is there any discussion on the paper by Dr. Hall?

DR. FITCH: Mr. President, Dr. Hall spoke in regard to blackhead in turkeys, and stated that the parasite causing this infection had driven the industry out of several states. We have had some experience with that in Minnesota. We started some experimental work in connection with blackhead some three years ago, with especial reference at that time to therapeutic measures that could be applied in the suppression of this disease. We did not get satisfactory results, but, outcropping from that work, we developed a method of raising turkeys in captivity, as it were.

There is a notion prevailing, without any basis, that turkeys cannot be raised except on range country, as it were. We showed that turkeys could be raised in very small yards; the eggs could be hatched in the incubator and brooded satisfactorily under artificial conditions.

This last year our Extension Department has placed this in practical effect throughout many sections of the State. The other day I was talking to Dr. Billings, who has this in charge, and he told me the results have been highly satisfactory.

We have in Minnesota a class of live stock of which we are not only proud, but which is an asset to the State—our wild animals and especially our deer. This last spring, in several sections of northern Minnesota, especially in the range country, numbers of the deer died from the effects of something which has proven to be a parasite, a nose warble, similar in many ways to that affecting sheep. It does not cause a direct death, but the parasite approaches so close to the brain that it produces nervous symptoms, so that the deer run into the lake and drown; break their necks by running against trees, or finally become so emaciated that they die. It has in this section of the State caused very serious losses among our wild deer.

PRESIDENT VAN ES: I will call for a report of a special committee appointed last year on the intradermic tuberculin test, of which Dr. Butler was appointed Chairman.

DR. BUTLER: This is a majority report, not a unanimous report.

. . Dr. Butler read the report. . . .

REPORT OF SPECIAL COMMITTEE ON INTRADERMIC TUBERCULIN TEST

DR. W. J. BUTLER, *Chairman*, Helena, Mont.

Dr. C. H. Case, Akron, Ohio
Dr. S. E. Bruner, Harrisburg, Pa.
Dr. C. H. Hays, Lincoln, Nebr.
Dr. W. J. Fretz, St. Paul, Minn.

A majority of your Committee, appointed to study the advisability or necessity in a change of technic and interpretation and recording of the intradermic tuberculin test, beg leave to report as follows:

1. We are of the opinion that a biological reaction such as occurs in a tuberculin test can not be interpreted on a basis of exact measurement; and that it is not to be expected that pathological findings will be correlated very closely with exact shapes and sizes of swellings; and further

2. That the individual veterinarian is responsible for the diagnosis made and on his judgment and experience together with his medical knowledge must rest his diagnosis. We are of the opinion that it is the character of the swelling rather than upon its size, that a diagnosis must be based.

3. We, therefore, at this time do not recommend any change in the present code or the adoption of any mechanical measuring-device, where measurements within the scope of such device must be construed as positive reactions, or where the reaction is not within the scope of mechanical measurement is to be construed as a negative reaction, but we do recommend that veterinarians performing the intradermic tuberculin test endeavor to acquire a definite sense of dimension, so that code reports of reactions may be more uniform.

(Signed) C. H. Case
S. E. Bruner
C. H. Hays
W. J. Butler

DR. BUTLER (continuing): Your Committee realizes that the present code is probably not 100 per cent perfect. This matter was thoroughly discussed, but we are of the opinion that, until we find some definite method or exact method of recording, we do not want to change. We have no desire to burden the men in the field with any additional clerical work, or with any new method of recording the intradermic tuberculin test. We realize that possibly some day in the future these reactions will be recorded in millimeters, but at the present time we are of the opinion that the code which is in existence now is adequate for our work.

I move the adoption of the majority report.

. . . The motion was seconded and carried. . . .

PRESIDENT VAN ES: The next number on the program will consist of ten-minute talks by commissioners of agriculture and live stock sanitary officials on subjects pertaining to live stock sanitary control.

MR. A. L. FELKER: I just want to say that New Hampshire is present and has been vitally interested in the splendid papers and discussions that have been rendered. We believe, while we are a small state in the number of cattle and live stock, we have some problems in common with those of other states, and we shall take back home some very helpful suggestions that we believe may be put into practice up in northern New England. We wish to say that we wish you God-speed in the splendid service you have rendered.

It is going to require, as Dr. Bundesen said yesterday, the spirit of push and intestinal fortitude. We have to have lots of it. I believe we are going forward, and we are going to win the fight in this splendid enterprise, that will means so much to the people of this country in rendering a greater salvation to them, through the saving of the live stock of this nation. (Applause)

PRESIDENT VAN ES: Does anyone else care to speak? If not, we will proceed. I will call for the report of the Committee on Nutritional Diseases.

DR. H. SCHMIDT: Mr. President, in view of the lateness of the hour and the large number of reports that are still be to presented, I move that this report be read by title.

. . . . .The motion was seconded, put to a vote and carried. . . . (Applause)

REPORT OF COMMITTEE ON NUTRITIONAL DISEASES

DR. H. SCHMIDT, *Chairman*, College Station, Texas

Dr. B. H. Edgington, Reynoldsburg, Ohio
Dr. H. C. H. Kernkamp, St. Paul, Minnesota

CALCIUM AND PHOSPHORUS

That calcium and phosphorus metabolism is interdependent to a certain degree has been repeatedly emphasized. That both must be present in the food in rather large amounts and in proper proportion is reflected in the German standard for mineral requirements which calls for not less than 1 per cent calcium oxid and 0.4 per cent phosphoric acid[1] in good hay. Experiments on calcium and phosphorus balance, particularly on dairy cows on ordinary winter rations, have shown that under practical conditions and with a proper choice of food and management, the bad effects of a calcium and phosphorus deficiency can be successfully forestalled. As such must be mentioned the feeding of leguminous roughage, curing of the hay with a minimum of exposure to dew and rain, maximum use of green feed, maximum exposure of the cows to direct sunlight, and a maximum resting period between the periods of lactation.

There are, however, large areas in the United States that are devoted primarily to beef cattle production. There is much of this area that does not support a vegetation that contains sufficient amounts of calcium and phosphorus to insure a proper development of the growing animals and where nutritional diseases involving the skeleton are often encountered. In some instances a deficiency of phosphorus has been established,[2, 3, 4] and the supplemental feeding of bone meal or other phosphates has satisfactorily relieved the situation. Also the application of phosphate fertilizers to the soil gave satisfactory results.[2]

That the utilization of calcium and therewith of the phosphorus in the metabolism of the animal is dependent upon another factor, vitamin D, has repeatedly been shown, but under practical conditions the amount of this factor present in the feed normally consumed by the bovine seems adequate except under very extreme conditions. It is well known that heavily producing milk cows, especially when on winter rations, are frequently in a negative calcium balance. When such animals are supplied with sufficient amounts of vitamin D, either in the form of green feed, properly cured hay, cod-liver oil, or with feed properly irradiated with the ultraviolet light, the negative calcium balance will be converted into a positive one, provided the calcium consumed in the ration is sufficient.

Calcium metabolism is also interfered with by excessive consumption of fluorin. This has been particularly shown on rats. Schultz and Lamb[5] fed white rats a basal ration consisting of yellow corn, 76 parts; meat-meal tankage, 10 parts; linseed oil meal, 10 parts; bone meal, 2.5 parts; and common salt, 0.5 part. No ill effects on growth and well-being were observed until 0.1 per cent or more of sodium fluorid was fed with this basal ration. A very marked toxic effect was observed when 0.15 per cent to 0.25 per cent was fed, interfering with growth and reproduction and even causing early death. It appeared that the effect upon reproduction began at a level of 0.025 per cent sodium fluorid. It also had the well-known and remarkable effect upon the upper incisors which grew quite long, curved upwards, and became quite brittle.

Hart, Steenbock and associates have continued their experiments on dietary factors influencing calcium assimilation. Following their finding that milking-goats can be placed on a positive calcium balance when the animals were irradiated with ultraviolet light, they sought to determine the effect of sunlight on the calcium assimilation on milking cows on a ration consisting of grain, grain supplements, corn silage and green grass.[6] When the cows were exposed to the sun for five hours daily and when such a ration contained 0.52 per cent calcium oxid, calculated on a dry basis and the total daily intake amounted to 70 to 80 grams CaO, the negative calcium balance could be reduced as compared to the balance when the cows were kept in the dark, but it did not become positive. When the animals were kept under the same condition and fed the same ration as before, but with the addition of one-half pound marl ($CaCO_3$) daily, so that the ration contained 1.5 per cent CaO, calculated on a dry basis,[7] with a daily intake of approximately 200 grams CaO, the cows remained in a positive calcium balance no matter whether the experiment was carried out in the dark or in sunlight. The authors concluded that these results would support the view that it is desirable to supplement the ordinary summer ration (non-leguminous) of liberally milking cows with some lime carrier.

The outcome of the experiment was apparently not expected by the authors and they, therefore, proceeded to try ultraviolet irradiation of the cows[8] similarly as they had previously done with milking goats.

Their conclusions from this experiment are:

1. Apparently ultraviolet light has little, if any, direct influence upon the calcium and phosphorus metabolism of dairy cows.
2. Ultraviolet light has no influence either favorable or adverse upon milk-production in cows.
3. Ultraviolet light has no apparent influence upon the calcium and phosphorus content of milk secreted.
4. It is suggested that this species (the cow) derives its anti-rachitic vitamin from the feed and is different in this respect from man, the goat, the chicken, and probably the rat, all of which can be favorably influenced directly by the short wave-lengths of solar radiation.
5. These data should not be interpreted as indicating that the exposure of the dairy cow to sunlight is not beneficial.

Sodium

Normal growth is also interfered with in chickens and rats by a deficiency of sodium in the ration. Mitchell and Carman,[9] using ground corn, 87 parts; casein, 10 parts; cod-liver oil, 2 parts; and calcium carbonate, 1 part, as a basal ration, conclude that the addition of 1 part of sodium chlorid to this ration enhanced its growth-promoting value. Miller,[10] using corn, casein and cod-liver oil as a basal ration, to which sodium chlorid, sodium sulphate, sodium carbonate and calcium carbonate were added as supplements, found that when such basal ration consisted of 80 per cent corn and when fed to rats did not sustain normal growth and reproduction when sodium was lacking. This basal ration, when supplemented with sodium sulphate and calcium carbonate, was deficient in chlorin but this had little effect upon growth and reproduction.

Potassium

Potassium is also one of the necessary elements in the animal body. Miller[11] found in experiments with rats that rations containing less than 0.1 per cent potassium greatly retarded growth but did not greatly interfere with the actions of the animals though they evidently craved something. Later Miller repeated this work[12] and found that young rats, on a ration containing less than one milligram of potassium per day, failed to grow and died within eight weeks. He concluded that the minimum daily potassium requirement for normal growth in the male is approximately 15 milligrams and for the female approximately 8 milligrams, but that the daily maintenance requirement of potassium for a mature animal is not over 2 milligrams. Based upon the potassium requirement for this type of animal and the content of

potassium in natural foodstuff, the potassium requirement for animal development is abundantly satisfied in the ordinary ration.

Whether potassium is always supplied in sufficient amounts when the animals are at pasture needs further investigation. Ibele[13] has attributed licking disease of cattle more to a lack of potassium than to a lack of phosphorus and calcium in the food consumed. At any rate he has secured very favorable results by the addition of beet molasses to the licking-disease-producing hay and attributed this remarkable effect to the high potassium content in organic form in beet molasses.

Iron

Simmonds, Becker and McCollum[14] report that xerophthalmia, identical with that observed in vitamin-A deficiency, developed in rats fed on a diet containing an adequate amount of vitamin A and a small amount of ferrous sulphate. They found that an addition of wheat-germ oil containing vitamin E to this diet would prevent the development of xerophthalmia. They also found that xerophthalmia would not develop on this diet if ferric citrate was substituted for ferrous sulphate. It was later found[15] that in the case of feeds that contained vitamin A, ferrous sulphate caused the destruction of the vitamin and that this destruction or, possibly, inactivation is inhibited by the inclusion of a small amount of wheat-germ oil in the diet. It is suggested that this substance might be vitamin E.

Simmonds, Becker and McCollum[14] also suggest from the results obtained that the death of the fetuses in rats on diets deficient in vitamin E is due to a crisis in their iron assimilation, which can be obviated by providing vitamin E in appropriate amounts from the beginning of pregnancy.

That iron is a component part of hemoglobin and that a lack of this element leads to anemia has long been known. Such cases of anemia can be readily produced in rats and rabbits when placed on a milk diet and can be prevented by the addition of green cabbage plus iron oxid (Fe_2O_3)[16] or the ash of lettuce and cabbage[17] and also by the addition of certain iron salts, especially the ferric compounds.[18] Under practical conditions a lack of iron in the food of animals is not often encountered on a large scale. Such is the case, however, in New Zealand, where at least one million acres are affected, and probably also in Africa, and in the north in Great Britain.[19] It is impossible to raise sheep or cattle on such areas in New Zealand if they must subsist on the native vegetation. Horses are not affected. If turnips or hay harvested from such affected land is fed to ruminants in addition to grasses of such areas they will remain healthy. The same is true if molasses, bran and other imported concentrated foodstuffs are allowed, even though in small quantities, where the animal grazes on the affected areas. If an affected animal be removed to a healthy pasture where it recovers and is then returned in poor condition to the affected area it will fatten and improve greatly in condition. This would indicate that the organic food constituents are present in sufficient amounts. Analysis of the blood of sick animals has shown a great deficiency of iron. Likewise, the soil of the affected area which is composed of pumice is found to be much lower in iron than the soil of healthy areas. Analyses of the fodder, plants, grasses and clovers from the affected areas show that the iron content of the ash may sink to .05 per cent which is very much lower than that of similar plants growing in healthy areas.

Numerous and long-continued feeding experiments on cattle and medical treatments have demonstrated conclusively that many substances may mediate or postpone the onset of disease observed, but there is only one which will bring an animal back to health when badly affected, the food being unchanged. That substance is a soluble salt of iron, the best of all for the purpose being the double citrate of iron and ammonia.

Requirements of Cattle for Vitamin A

Brief reference has already been made, in the report of this committee for 1926, as to the requirements of bovines for vitamin A. A few additional data have become available in the meantime, which will be reported herewith.

As already pointed out in a previous report, most of the facts on vitamin A were derived from experiments with small laboratory animals. Eckles, Jones

and Palmer[20] placed a number of calves on a vitamin-A-deficient diet soon after birth, with the idea of determining the influence of the lack of this vitamin on the health of the calf. On the whole it was observed that after vitamin-A deficiency had been fed for two or three months, the calves would show a decline in the rate of growth, become unthrifty, develop scours, a discharge from the eyes and nose, and xerosis of the eyes. Among the post-mortem lesions were found pneumonia, edema of the kidneys, atrophy of the intestines, necrosis of the rumen, and sclerosis of the liver. On the whole the liver of such calves tested on rats did not store vitamin A. When as much as 20 cc of cod-liver oil a day was allowed calves showing a vitamin-A deficiency, prompt recovery took place. The authors summarize their results as follows:

1. The experimental results with nine calves show that vitamin A is an indispensable factor in the diet of calves.
2. The characteristic symptoms of vitamin-A deficiency in other species of animals, including failure to grow, xerophthalmia, respiratory troubles, diarrhea and death, occur in herbivora, as represented by calves.
3. Cod-liver oil feeding causes a resumption of growth and a disappearance of abnormal symptoms in calves declining on a vitamin-A-deficient ration.
4. Less than 1 per cent of cod-liver oil in a ration otherwise practically free of vitamin A allows calves to grow normally.
5. Vitamin A is present in large amounts in liver of calves fed normal rations but is absent from the liver of calves fed vitamin-A-deficient diets.
6. Wheat straw is a good source of vitamin A for ruminants.
7. White corn (Rustler White variety) and dried beet pulp are practically free of vitamin A.
8. Dried beet-pulp can be used as a roughage for growing calves provided they receive adequate vitamin A in the other constituents of the rations.
9. Skimmilk powder, oxidized by exposure to light and air until it becomes tallowy, is practically free of vitamin A.

Vitamin-B Requirements for Cattle

As already reported by this Committee, Theiler and his associates[21] fed cattle ranging from 44 to 52 weeks on a ration consisting of polished rice supplemented with a small amount of autoclaved roughage. They observed no evidence of beri-beri symptoms and suggest the possibility of cattle being able to synthesize vitamins by means of bacterial symbiosis in the digestive tract. More recently Beckdel, Eckles and Palmer studied the vitamin-B requirement of the calf.[22] After two preliminary experiments, eight calves were placed on a vitamin-B-deficient ration, as shown by rat-feeding experiments, at ages varying from 112 to 179 days. They were continued on the vitamin-B-deficient ration until maturity, or until five of them dropped their first calves.

In the second part of the experiment, four cows were placed on a vitamin-B-deficient ration, from six to eight weeks before they were due to calve. Three calves from these four cows were available for another experiment. These three calves were fed on whole milk as their sole ration from one of the four cows on the vitamin-B-deficient ration until they were about eight weeks old. At this time they began eating the experimental concentrated mixture deficient in vitamin B and some dried beet-pulp. Milk from the cow receiving the vitamin-B-deficient ration was continued for two calves until they were 115 days old and for the third calf until it was 147 days old. The authors concluded that a calf will grow normally to maturity and produce normal offspring on a ration that gives an insufficient amount of vitamin B to support growth and general well-being in rats. Assuming that the calf possesses a physiological requirement for vitamin B similar to that of other animals, the deportment of the experiment calves described in this paper can be explained only on the basis of vitamin-B synthesis by bacteria or other micro-organism in the digestive tract, unless future investigations should prove that various species of animals differ materially in their vitamin-B requirement. The conclude also that the milk produced by cows on a ration deficient

in vitamin B is appreciably, but not markedly, reduced in its vitamin-B content.

Beckdel and Honeywell[23] further experimented with the milk of the cows raised from calfhood on a vitamin-B-deficient ration. When the cows calved, their milk was fed to rats to determine their vitamin-B content. The vitamin-B potency of this milk when fed to rats was found equal to that of herd milk from cows receiving a good winter ration. It is concluded that vitamin B in milk is not dependent upon the presence of this vitamin in the ration of the cow. It would appear that cattle, and possibly all ruminants, differ from other animals in their ability to grow to maturity, produce normal offspring, and maintain vitamin B in their milk, when forced to subsist on rations deficient in vitamin B. If this is true it would appear that ruminants possess the power to synthesize vitamin B. It is not yet known whether this synthesis is due to microorganisms present in the rumen.

The author has found only one reference in the literature regarding vitamin B requirements of the horse.

Niato, Shimamura and Kuwabara[24] report that in general in horsest he same symptoms of vitamin-B deficiency are observed as in small laboratory animals. Thus, they report a reduction in the appetite and body weight and paralysis of the hind quarters. The behavior of the heart (irregular and skipping pulse of 100 to 180 beats), increased body temperature, non-affection of the gastro-intestinal tract, the presence of acidosis and of hypoglycemia are the main points in which the vitamin-B deficiency in the horse corresponds with beri-beri in man and in contrast to that of small laboratory animals.

Vitamin-C Requirements for Cattle

Only one instance was found in the literature where experimental studies of the vitamin-C requirements for cattle have been recorded. Thurston, Eckles and Palmer[25] have conducted two experiments on calves with vitamin-C-deficient rations as indicated by feeding experiments on guinea pigs. In the first experiment two calves were placed on such a ration when the calves were approximately 100 days old and continued on the ration for a period of about one year. In the second experiment, calves two weeks old were placed immediately under conditions which would minimize the possible storage of the anti-scorbutic factor. One of these calves was from a cow which for three months previous to calving had received a ration very deficient in vitamin C. Three other calves were obtained from a local market. The rations used as indicated by guinea pig trials were deficient in vitamin C. The feeding of the calves was carried on over a period of one year. From their results the authors conclude:

1. Calves do not require vitamin C in quantities that can be measured by the present method of testing food materials for their antiscorbutic potency by feeding them to guinea pigs. Under practical conditions, even where very poor feeding practices are followed, there is little if any reason to believe that the well-being of the calf will be affected by a shortage of vitamin C.

Nutritional Diseases of Poultry

During the past year the relationship of vitamins, radiant energy and inorganic elements has received much attention from various investigators.

The usual recommendation of dietary minerals, calcium and phosphorus, has been with the thought of supplying a maximum amount of these elements. What danger if any might accrue from an excess of these minerals received but little consideration.

In work reported by Mussehl and associates,[26] in which chicks were used as test animals, the addition of minerals to a basal ration "apparently complete for vitamins, satisfactory for proteins as well as inorganic constituents," was harmful. The addition of four parts calcium carbonate to the basal ration resulted in a checking of growth of the chick, whereas the addition of eight parts was quite disastrous.

That these results were not due to a disturbance of the calcium-phosphorus ratio is indicated by the findings, when eight parts raw bone meal, claimed to increase the calcium and phosphorus content of the ration with slight change

in the ratio of these elements, was added to the basal ration. Such diet resulted in the development of rickets in 19 of 21 surviving chicks.

While these investigators do not draw definite conclusions, they state that "the common opinion that excess mineral elements make for safety in chick nutrition, and at most can do no harm, seems ill founded."

Results of other investigators tend to confirm these opinions: Bethke reports[27] that the addition of 4 to 5 per cent lime in the form of calcium carbonate, limestone or oyster shells, in a ration containing cod-liver oil and bone meal, causes slower and more uneven growth in chicks and an increased mortality.

Nutritional Diseases of Swine

Investigations in nutritional disturbances of swine during the current year have in a great measure been continuations of those already reported in dealing with mineral and vitamin supplements, and radiant energy.

Following the work of Steenbock, Hart and Jones[29] and others[30] on the influence of direct sunlight on mineral metabolism, it became apparent that the interpretation of results of former feeding trials, in which radiant energy was not taken into consideration, must be reconsidered.

Bethke and Edgington[30] have shown that pigs on a basal ration of yellow corn and soy bean supplemented with calcium carbonate and salt, when kept away from direct sunlight, developed rachitic changes, whereas those allowed a similar diet and outside pens with wood floors were apparently free of such lesions.

The high death-rate of young pigs during the past few years has commanded the attention of several investigators. It would appear that some important dietary factor or factors, as yet not well understood, are responsible for a form of anemia very frequently seen in young pigs.

McGowan and Crichton[31] and McGowan[32] report upon anemia of pigs three or four weeks of age which was attributed to an iron deficiency. Briefly the lesions seen were: enlarged heart, effusion of fluids into various serous cavities and fatty changes and necrosis of the liver lobules

Doyle, Matthews and Whiting[33] have reported a condition that is apparently similar in character. The most constant gross lesions appeared in the liver. The organ was somewhat enlarged and finely mottled with greyish-yellow areas. Hemorrhages into the liver were common. Serous fluid and fibrin masses were frequently seen in the abdominal cavities of pigs dying with anemia. The heart was usually dilated, often to such extent as to disturb the normal lung position. The blood appeared pale, as did most of the visceral organs.

In three experiments reported, pigs on varying rations allowed inside and outside exposure were compared. Of 277 one-week-old pigs, 146 were kept under inside conditions and 131 under outside conditions, the rations being similar. According to these investigators, "anemia was almost four times as prevalent, and the death-rate, between the ages of one and eight weeks, was nearly four times as high under inside conditions as under outside conditions."

The anemia was not appreciably affected by cod-liver oil, yeast, or orange-juice added to the ration. Nor did the addition of iron lactate to a ration of corn, meat scraps, wheat bran, middlings, cod-liver oil and mineral supplement prevent the anemia when the pigs were held under inside conditions.

Pigs were rarely affected after six weeks of age, spontaneous recovery beginning at about that age.

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PRESIDENT VAN ES: The next is the report of the Committee on Miscellaneous Transmissible Diseases.

. . . Dr. A. W. Miller read the report. . . .

REPORT OF COMMITTEE ON MISCELLANEOUS TRANSMISSIBLE DISEASES

DR. A. W. MILLER, *Chairman*, Washington, D. C.

Dr. E. A. Watson, Ottawa, Ont.
Dr. William Moore, Raleigh, N. C.
Dr. Charles Murray, Ames, Iowa
Dr. C. H. Case, Akron, Ohio
Dr. C. J. Marshall, Philadelphia, Pa.
Dr. J. H. McNeil, Trenton, N. J.

Your Committee is limiting its report this year to a discussion of rabies, glanders and foot-and-mouth disease. In order that we might be able to place before you accurate and timely information concerning the present situation with respect to the first two of these diseases, a questionnaire was sent to the official in charge of live stock sanitary control work in each of the states and Canada. Replies were received from all these officials. As a part of this report, we are including brief summaries of these replies which contained a great deal of valuable data.

Rabies

(a) *Existence of disease during present calendar year:* Minnesota, Montana, North Dakota, South Dakota and Utah were entirely free from the disease. Only a few cases were reported as occurring in the states of Alabama, Florida, Idaho, Kentucky, Louisiana, Maine, Nevada, New Hampshire, New Mexico, North Carolina, Rhode Island, South Carolina, Tennessee, Texas and Washington. In the other 28 states, outbreaks ranged from a minimum of 35 cases to a maximum of 634. Infected animals were largely dogs, although in some of the western range states a considerable number of cases were reported in predatory animals, chiefly coyotes. In Canada, during the year ended March 31, quarantines were placed in Prince Edward Island, 16 counties in the province of Quebec, and 8 counties in Ontario. During 1925, the last year for which we have been able to obtain statistics, the United States Public Health Service reported 94 deaths in man from this disease.

(b) *Regulations governing the control of rabies in live stock:* Two states, Maine and South Dakota, report no regulations. All of the other states have either state regulations or local ordinances. However, in four states, California, New Jersey, New Mexico and New York, the public health service instead of the state live stock sanitary authorities has jurisdiction over rabies control work in live stock.

Nine states have requirements governing the importation of dogs from other states, designed to prevent the introduction of rabies. Arizona and Wyoming require certification showing that no rabies has existed at the point of origin within six months of the date of shipment. An affidavit from the owner or a certificate from a veterinarian that rabies has not existed within 25 miles of the point of origin within three months of shipment is required on dogs destined to Oregon. In lieu of the affidavit or certificate, dogs will be admitted into that state if accompanied by a certificate showing that they have been vaccinated not more than a year prior to shipment. On shipments to Idaho, it is necessary that the certificate show non-existence of rabies in the district of origin for six months immediately preceding shipment. The Washington requirement is a certificate of freedom from disease and immunization against rabies within six months of shipment. Texas has a similar requirement except that immunization may be administered not more than ten months before shipment. Minnesota, North Dakota and Montana require a certificate showing that rabies has not existed for nine months within fifty miles of the point of origin. In addition, North Dakota requires vaccination within six months and Montana within twelve months, prior to the date of shipment.

(c) *Control measures:* Quarantine or muzzling, or a combination of these measures, is a requirement of all but five or six of the states. Vaccination is extensively practiced, being a requirement in some states in infected localities and in a considerable number of cities.

(d) *Methods of vaccination:* The single-injection method is generally used, except in the case of exposed animals, which are usually given repeated injections. The state authorities report varying results from this treatment. The majority seem to think that it possesses some value, especially when administered to animals that have not been exposed. A few express a doubt as to its efficacy and two or three state that in their opinion a better vaccine must be placed on the market than that which is being used at the present time.

(e) *Protective value of vaccine:* Failures to afford protection to treated animals are reported in a considerable number of instances.

(f) *Prevalence of disease:* In seventeen states the disease was reported as on the increase and in eight as less prevalent than formerly.

(g) *Measures recommended or more effective control:* Practically all authorities agree that rigid quarantine and destruction of every stray or unowned dog are essential if headway is to be made in the campaign to eradicate this disease. Strict enforcement of a dog-licensing law in order to effect the disposal of worthless animals is stressed by several authorities. A number recommend compulsory vaccination of all dogs in infected localities.

Your Committee concurs in the view that the destruction of stray and worthless dogs is of the utmost importance. In our opinion it is not safe at this time to substitute vaccination for rigid quarantine in the control of rabies. As an indication that vaccination is considered to possess some merit by persons who are in a position to speak with authority on the subject, attention is invited to the first International Medical Conference sponsored by the Public Hygiene Committee of the League of Nations, which was devoted to rabies. The meetings took place at the Pasteur Institute, in Paris, during the last week of May, and the Commission was presided over by Professor Bordet, of Belgium. Representatives of some thirty nations were present, among whom were a number of noted bacteriologists and directors of Pasteur Institutes. The Commission expressed the opinion that it was desirable to immunize animals in districts where rabies was prevalent, using a single inoculation of killed or attenuated virus and repeating this at intervals of one year. It was recommended that vaccinated dogs known to have been bitten by rabid animals should be destroyed, but, if only suspected, they might be vaccinated again and kept under observation for six months. The Commission expressed the view that the complete eradication of rabies depended upon the restriction of dogs to premises of their owners, unless they were muzzled, and the destruction of stray animals.

Glanders

(a) *Existence of disease:* The states of Alabama, Delaware, Florida, Georgia, Idaho, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Nevada, New Hampshire, New Jersey, New Mexico, Ohio, Oregon, Rhode Island, South Carolina, Texas, Utah, Vermont, Virginia, West Virginia and Wyoming, 26 in all, reported no outbreaks within their borders during the present calendar year. The other 22 states reported cases as follows: Arizona 1, Arkansas 7, California 154, Colorado 1, Connecticut 2, Illinois 10, Indiana 2, Maine 2, Minnesota 10, Mississippi 12, Missouri 5, Montana 3, Nebraska 14, New York 1, North Carolina 3, North Dakota 30, Oklahoma 1, Pennsylvania 7, South Dakota 10, Tennessee 2, Washington 2, and Wisconsin 2. In Canada, during the year ended March 31, 1927, the disease was detected in Quebec on seven premises, on which 17 infected horses were found.

(b) *Mallein test requirement:* Thirty-four states expressed the opinion that under existing conditions a state requirement that horses shipped from one state to another be accompanied by a mallein test certificate was no longer necessary. Seven consider such a requirement necessary and the remainder were either non-committal or expressed the view that the test should be required only on horses from certain states.

We concur in the majority opinion that a general requirement that horses shipped from one state to another be mallein-tested is unnecessary. We recommend that where the mallein test is applied, the intradermic method be used in preference to the ophthalmic or subcutaneous.

Foot-and-Mouth Disease

The wave of foot-and-mouth disease which was at its crest a year ago in Denmark, the Netherlands, Belgium, France, Germany and Poland has subsided and conditions in those countries this year have been far better than for several years. Norway has been entirely free for several months and only a few outbreaks have occurred in Sweden.

England has made further progress in its eradication campaign, 47 outbreaks having occurred during the first 45 weeks of this year, as compared with 208 for the whole of the calendar year 1926. The United States and Canada removed the prohibition against the importation of domestic ruminants and swine which had been in effect since 1923, and resumed the issuance of permits on June 7, after England had been entirely free from foot-and-mouth disease since April 7. A few shipments came forward but a recurrence of the disease on July 7 caused the cancellation of all outstanding permits and since then shipments from that country have been prohibited.

Scotland, where the disease was introduced last year in infected pig carcasses, has experienced no outbreak this year.

Coming nearer home, we find that the island of Jamaica and Mexico, apparently, have succeeded in eradicating the disease, no outbreaks having been reported in the former since July, 1926, and none in the latter since November 19, 1926. It has now been more than two years since there has been an outbreak of foot-and-mouth disease in this country.

Important contributions have been made by the British Foot-and Mouth Disease Research Committee to the literature on this disease. Of particular interest to live stock sanitarians are the results of their experiments to determine the time that the virus will survive under varying conditions. These are given in an article in the April, 1927, issue of the *Journal* of the British Ministry of Agriculture, from which the following extract is taken:

> "(3) *Determination of the Time the Virus Survives upon Glass, Hair, Fodder, Carcasses, etc.*—When dried rapidly on glass slides the virus does not usually survive the drying process, but if dried slowly and then kept chemically dry it has survived for six months; when kept in a moist atmosphere the virus is inactive after two days. These experiments did not suggest that under ordinary conditions of the atmosphere virus dried on inanimate objects which chanced to receive it would survive for long and serve to pass on the infection.
>
> "When dried on silk and woolen fabrics the virus survived from 7 to 14 days; on hay at least 15 weeks; on bran at least 20 weeks; on flour 7 weeks; on cow's hair 4 weeks; on sand 2 weeks; and mixed with salted butter 2 weeks. When mixed with an extract of hay and dried at ordinary temperatures, the virus was found to be active after 15 days; in a control, using distilled water instead of hay extract, the period of survival was 4 days. An experiment carried out at the Experimental Station showed that it was possible to infect farm animals by feeding with dry fodder which had been sprayed a month previously with diluted infective saliva.
>
> "It has been found that tissues from the bodies of guinea-pigs, killed when the blood was infective, remain virulent for considerable periods in cold store; the blood was virulent after 36 days and the bone marrow up to 96 days. Epithelium from the lesions was infective after 102 days. In the carcasses of cattle and pigs slaughtered in the early stages of foot-and-mouth disease and kept under ordinary cold storage conditions, virus has remained active for 40 days in the blood and 76 days in the bone marrow. After dry or wet salting, the virus was recovered from the bone marrow after 42 days. The disease was readily conveyed to pigs by feeding them upon crushed bones from frozen carcasses containing infected marrow. Imported carcasses of pigs with lesions of foot-and-mouth disease on them were proved to contain the virus by infection of cattle at the Experimental Station with material from the foot lesions.
>
> "Burial of the carcasses with lime did not shorten the period of infectivity. In some of the brine mixtures ordinarily used by the trade the virus was not recovered from the feet after five days, but in others it was present after a month."

DR. MILLER: I move the adoption of this report.

. . . The motion was seconded. . . .

PRESIDENT VAN ES: Are there any remarks?

DR. IVERSON: I think Dr. Miller's reference to the number of horses slaughtered last year for glanders in California needs some explanation, of rather additional information. It proves two things, Mr. Chairman and gentlemen. It proves that California is a believer in horses and mules, and that we have not given the entire state over to tractors and gasoline machinery. Secondly, it proves that California is active in eradicating the infection.

The reason we had a greater number of horses slaughtered for glanders last year in California is simply this: One large firm owning several million acres of land and owning, I think, about 6,759 horses and mules, unfortunately had latent infection among some of their horses, and it spread insidiously, of

course, as the disease does. For some time it went unnoticed. As soon as its presence was known, every animal owned by the firm was tested, and all reactors were destroyed. The 154 reported destroyed for glanders were mostly reactors to the mallein test. There were very few clinical cases. Most of the animals were retested. I feel that I can truthfully say that that was the last stand of glanders in California. Now it is gone and out of existence, and we have made the same progress in the control of glanders that we did in the control of Texas fever. (Laughter and applause)

PRESIDENT VAN ES: Are there any further remarks? If not, are you ready for the question?

. . . The question was called for, put to a vote and carried. . . .

PRESIDENT VAN ES: The Advisory Committee, Dr. Mohler. Is any one here in lieu of Dr. Mohler? No Dr. Mohler, no report. (Laughter)

Committee on Policy, Dr. Jacob.

DR. IVERSON: Dr. Jacob requested me to present the report in his absence.

. . . Dr. Iverson then read the report. . . .

REPORT OF COMMITTEE ON POLICY

DR. M. JACOB, *Chairman*, Knoxville, Tenn.

Dr. B. W. Conrad, Sabetha, Kan. Dr. J. P. Iverson, Sacramento, Calif.

A careful review of the program on policy, as previously adopted by this Association, as a guide for the further strengthening of live stock sanitary control work, appears to fulfill the immediate needs. It is therefore the unanimous opinion of your Committee that modification of or additions to the present policy are not necessary at this time.

DR. IVERSON: I move the adoption of this report.

. . . The motion was seconded, put to a vote and carried. . . .

PRESIDENT VAN ES: The report of the Committee on Unification of Laws and Regulations. Dr. W. F. Crewe. (Applause)

. . . Dr. Crewe read the report. . . .

REPORT OF COMMITTEE ON UNIFICATION OF LAWS AND REGULATIONS

DR. W. F. CREWE, *Chairman*, Bismarck, N. D.

Dr. C. H. Hays, Lincoln, Nebr. Dr. F. A. Zimmer, Columbus, Ohio
Dr. W. J. Embree, Chicago, Ill. Dr. U. G. Houck, Washington, D. C.
Mr. M. G. Thornburg, Des Moines, Ia. Dr. Edward Records, Reno, Nev.

In submitting this report the Committee wishes to reiterate and recommend the recommendations contained in the report of the Committee on Uniform Regulations for the year 1925, as contained in the proceedings of the twenty-ninth annual meeting of the United States Live Stock Sanitary Association, page 178.

This Committee believes that the recommendations contained in the 1925 report should still be used for reference in an effort to bring about more uniformity in laws and regulations pertaining to live stock sanitary control work.

This Committee sent the following questionnaire to the state live stock sanitary officers of the forty-eight states and received replies from thirty-nine states, for which we are duly thankful:

QUESTIONNAIRE REGARDING UNIFORM LAWS AND REGULATIONS PERTAINING TO THE PREVENTION AND ERADICATION OF COMMUNICABLE DISEASES OF LIVE STOCK

1. *Has your state by law or regulation adopted any of the recommendations made in the report of the Committee on Uniform Regulations, United States Live Stock Sanitary Association, Year 1925?*

The answers indicate that thirteen states had followed the recommendations. Fourteen states advise that no change had been made in laws or regulations

since 1925. So it would seem that some progress had been made in the right direction.

2. *If any of the recommendations have been adopted, kindly indicate to what extent.*

This question was answered by practically all officials in answering question 1.

3. *There seems to be some conflict regarding regulations adopted by some of the western states regarding the interstate movement of baby chicks. Kindly express your opinion on this.*

The answers indicate that twelve favor regulations pertaining to the movement of baby chicks. Six officials state that such regulations are not practical. Seven officials are opposed to such regulations. Two states were indifferent. It would appear from these answers that twelve states favor certain restrictions and fifteen states do not favor any restrictions.

4. *There seems to be some controversy regarding the adoption of the word "accredited" to disease-free flocks of poultry. What is your opinion regarding this?*

Twenty states approve the use of the word "accredited," properly qualified, to apply to disease-free flocks only. Seven states were opposed to the use of this term at this time.

This Committee has been requested to make recommendations regarding the accreditation of flocks for freedom from disease.

This Committee conferred with the Committee on Poultry Diseases of this Association, asking them to submit a plan for such accreditation.

The plan was submitted, as follows, and received the endorsement of this Committee:

RECOMMENDATIONS REGARDING ACCREDITATION OF FLOCKS FOR FREEDOM FROM DISEASE

1. That the word "accredited" be used only to indicate freedom from disease;

2. That when the word "accredited" is so used, the name of the disease to which reference is made be attached, as in the following examples:

Accredited Bacillary White Diarrhea Free,
Accredited Tuberculosis Free;

3. That a flock shall not be accredited as free from any disease until it has passed at least two consecutive negative official tests at intervals of not less than six months nor more than one year apart. Progeny of accredited birds may become accredited after one negative official test. It is understood that in all cases, the word "flock" indicates 100% of all birds on the farm;

4. That to remain accredited the flock must pass a negative test once yearly. All birds added to an accredited flock must come from other accredited sources and be subjected to an official test before being added to the flock. They must be placed in quarantine until such time as an official test is made and reported;

5. That when it is desirable to indicate that a flock has been tested for a disease before it is eligible for accreditation as being free, it may be listed as such, providing that it be indicated as "tested and reactors removed" and a definite statement is made as to the date of the test, the per cent reactors, and the number of years of consecutive testing; and

6. That all official accreditation of flocks be done by the state live stock sanitary boards or other similar official state organizations.

This Committee recommends that in the instance of states passing laws or establishing regulations pertaining to the movement of baby chicks that the plan recommended in this report for the establishment of disease-free flocks be adopted in the interest of uniformity.

It is contended that the tests for bacillary white diarrhea have not been perfected to the extent that they are absolutely reliable and in many instances it may be extremely difficult to eliminate the disease completely. However,

your Committee feels that some action must be taken and has made these recommendations accordingly.

In connection with state requirements that baby chicks and hatching eggs must originate from bacillary white diarrhea-free flocks, it is to be noted that these commodities to a large extent are shipped by parcel post. We have interviewed the Chief of the Bureau of Animal Industry as to whether the postal authorities would make effort to require that such shipments were accompanied by proper certificates. We were advised by the Chief of the Bureau that the Postoffice Department has informed him at different times that unless mailable matter was covered by a federal quarantine order that they would not refuse to accept or deliver under a state quarantine order.

We also asked the Chief of the Bureau if it was feasible or desirable for the Bureau to establish such regulation as would be recognized and observed by the Postal authorities. The Chief of the Bureau advised that in his opinion the time was not ripe to recommend the promulgation of a Department regulation requiring that baby chicks shipped from one state to another be accompanied by an acceptable certificate showing that they are from bacillary white diarrhea-free flocks. It was the Chief's opinion that it would be a tremendous undertaking and one that would require very large appropriations by the state and federal governments in order to make it at all effective. It was believed that if such an order was promulgated by the federal department that it would be recognized by the postal authorities.

This Committee has received complaint regarding health certificates issued for interstate live stock shipments, especially cattle. It is stated that in many instances shipments are made, accompanied by health certificates, but no copy or record of such certificates is forwarded to the sanitary official of the state to which such stock are destined.

This Committee considers that this is a very serious matter, as the evidence of health certificates received is about the only manner by which an official can keep track of the arrival of such stock within his state.

It has been suggested that railway companies be required to forward the health certificates attached to the waybills to the state official immediately after the arrival of the shipment at destination. Railway companies hesitate to do this, contending that these certificates should be held in their possession as evidence that they complied with the requirements in the movement of such shipments.

It would appear that as all inspectors authorized to make inspections of live stock for interstate shipment must be approved by the United States Bureau of Animal Industry and the state officials, their services are subject to regulation by the state official of state in which they operate.

Therefore, this Committee strongly recommends that all state officials should notify all approved veterinarians that they must strictly comply with the requirement of forwarding copies of health certificates or be subjected to having their names stricken from the list and be prohibited from making such inspections.

The attention of this Committee has been drawn to the fact that there is an excessive loss of pigs, especially feeder pigs, moving interstate originating from other than market centers supervised by the United States Bureau of Animal Industry.

It is stated that where data were collected it was shown that the loss was 17 per cent as compared with a 4 per cent loss on pigs originating from market centers. It is claimed that investigations show different causes for this loss. Pigs have been certified to as being vaccinated at thirty days simply on the statement of the owner or someone, to the veterinarian making the inspection. In some cases the veterinarian issued certificate of vaccination although he had no direct knowledge that they had been vaccinated. In some instances losses were incurred where veterinarians vaccinated pigs immediately prior to shipment without determining by taking temperatures whether such pigs were free from disease or not.

Your Committee recommends that state officials notify all approved veterinarians authorized to do this work, that they must comply strictly with all the regulations of the United States Bureau of Animal Industry regarding the

vaccinating and certification of feeder pigs for interstate shipment, and that they must determine beyond a doubt that such pigs have been properly vaccinated before certifying thereto.

We have been informed that the state of Mississippi requires that all horses and mules offered for shipment into that state must be accompanied by a temperature chart showing that their temperature was normal at the time of shipment.

The State Veterinarian of Mississippi states that since this requirement has been in effect it has been noticed that the death loss from shipping fever, etc., after arrival at destination, has almost disappeared.

This Committee feels that this is a matter worthy of serious consideration but that we have not sufficient data at this time to warrant making a recommendation.

DR. CREWE: I move the adoption of this report.

. . . The motion was seconded, put to a vote and carried. . . .

PRESIDENT VAN ES: The next is the report of the Committee on Legislation. Is Professor Smith here? Is any one here to speak in his place? If not, there is apparently no report.

The next report is that of the Committee on Resolutions. Dr. T. E. Munce. (Applause)

. . . Dr. Munce read the first part of the report of the Committee on Resolutions, concerning an adequate supply of veterinarians.

RESOLUTION

WHEREAS, It is common knowledge that the success of the live stock industry depends upon an efficient national veterinary service to guard against and to combat sporadic outbreaks of disease, and

WHEREAS, The official records show that the total number of graduates each year from all the veterinary colleges of the United States, at the present time, is so small that it is utterly inadequate to fill vacancies in the veterinary profession resulting from death and other causes, and

WHEREAS, The salaries paid by the U. S. Government to veterinary inspectors of the Bureau of Animal Industry, as compared with salaries paid by other employers of veterinary services, are so small, and the rate of promotion in the Bureau is so slow, that no forward-looking, thinking veterinary graduate will at this time consider accepting employment in the Bureau, except as a last resort, resulting in a dearth of veterinary inspectors in the Bureau, and the substitution of lay inspectors therefore, and

WHEREAS, To remedy this condition the Chief of the Bureau of Animal Industry and the Secretary of Agriculture, after careful investigation and determination of the minimum needs of the Bureau, have recommended that the sum of approximately $260,000 additional be appropriated by Congress to provide more adequate salaries for veterinary inspectors for the coming fiscal year, and

WHEREAS, This recommendation of the Secretary of Agriculture and of the Chief of the Bureau of Animal Industry has been disapproved by the Bureau of the Budget, and a sum of considerably less than one-half of the estimated amount has been approved, therefore be it

Resolved, 1. That this Association expresses the settled conviction that in the interest of the live stock industry of the Nation it is necessary that adequate provision be made for fair salaries and allowances for veterinary inspectors of the Bureau of Animal Industry.

2. That this Association commends Hon. Wm. M. Jardine, Secretary of Agriculture, and Dr. John R. Mohler, Chief, Bureau of Animal Industry, for their perspicacity in recognizing this necessity and endeavoring to meet it.

3. That this Association respectfully requests each senator and representative in Congress to use every proper effort in the coming session of the Congress to secure an appropriation for the coming fiscal year adequate

to the actual needs of the Bureau of Animal Industry, as those needs have been determined by the Chief of that Bureau, and by the Secretary of Agriculture.

4. That the Secretary of this Association be requested to send a copy of this resolution to each senator and representative in Congress, to the Secretary of Agriculture and to the Chief of the Bureau of Animal Industry.

DR. MUNCE: Mr. Chairman, I move the adoption of that resolution.

. . . The motion was seconded, put to a vote and carried. . . .

. . . Dr. Munce then read the next resolution. . . .

RESOLUTION

WHEREAS, The National Poultry Conference called by the U. S. Department of Agriculture to consider standardization of poultry breeding and disease eradication methods, voted 23 to 12 to subscribe to the plan submitted by the U. S. Department of Agriculture, and

WHEREAS, The plan is in harmony with recommendations made by this Association, therefore be it

Resolved, That the U. S. Department of Agriculture be urged to put the plan into effect at the earliest possible time, consistent with the best interests of the poultry industry.

DR. MUNCE: I move the adoption of the resolution.

. . . The motion was seconded, put to a vote and carried. . . .

. . . Dr. Munce then read the next resolution. . . .

RESOLUTION

WHEREAS, The United States Bureau of Animal Industry and the United States Department of Agriculture cooperates with the various states in the control and eradication of diseases of live stock, including poultry, and

WHEREAS, Ambiguity seems to exist in the meaning of the term "live stock," as it applies to regulatory work concerning poultry under the authority of the Bureau of Animal Industry of the United States Department of Agriculture, now therefore be it

Resolved, That the United States Live Stock Sanitary Association at its thirty-first annual session at Chicago, Illinois, November 30 to December 2, 1927, most respectfully urge Congress at the earliest possible date to amend the Acts of February 3, 1903, and March 5, 1905, so that live poultry without question shall be regarded as "live stock" under the terms of these Acts, to the end that the poultry industry of this Nation may be given protection in its times of need by the United States Department of Agriculture.

DR. MUNCE: I move the adoption of that resolution.

. . . The motion was seconded. . . .

PRESIDENT VAN ES: Are there any remarks?

DR. J. I. GIBSON: I suggest there be added to the resolution that it receive the same distribution as the one previously read, that the members of Congress be furnished copies of this resolution.

DR. MUNCE: That is agreeable.

PRESIDENT VAN ES: Are there any further remarks?

. . . The question was called for, put to a vote and carried. . . .

PRESIDENT VAN ES: The next in order is new business. Is there any new business? If not, then the next in order is the election of officers.

DR. N. F. WILLIAMS: This Association is a serious institution. It is dedicated to the purpose of maintaining environmental conditions favorable to the existence and perpetuation of humanity. We cannot lose that vision.

There is no hope for humanity except in the clear vision of the educated sanitarian.

We have reached a serious moment in the affairs of this Association, for at this time we must select those men who shall lead the destinies of this organization for the ensuing year. In a sense, this is a sacred obligation. It should be held above personal ambitions or limited interests. We might do well, in searching for our leaders, to examine the ranks of those grown strong in service, those who have fought so well and nobly, and hope the time will multiply their powers until the call from God comes to them for a service over yonder on the little golden island, in the flood of purple light.

Let us select, from one of these, the men that must lead on our forefront. Let us place with him our banner, and, as he holds it high above him, let us concentrate our forces, let us rally there beneath it, and, with unison of purpose, push that standard ever forward, and success will crown our efforts as a pleasing benediction of a providential choice.

I am sure the members of this organization will agree with me that the man whom I am about to nominate deserves this honor. First, preeminently, a leader, a leader by association, the honor will rest well with him, but, after all, as a charter member of this organization, we cannot but remember that this perhaps has come to him through the slow process of seniority. It is now my pleasure, as it is my duty, to place in nomination Dr. C. A. Cary, of Alabama. (Applause)

DR. BARGER: Mr. President, I appreciate particularly what Dr. Williams said about the control of disease and so forth, especially since Dr. Hall says that nodular disease has a foothold. I always presumed it was an intestinal disease, but he said it has a foothold.

Aside from that, I want to say there is a man in this crowd who, when the South was floundering around a bit, wanted a little recognition among the veterinary profession. I want to say he was a leader. He was the father of the profession. There was a time in the South when there were no veterinary medical associations. There was a time in the South when they tried to have associations. The man I have in mind came there and talked to those men. Many of them were students from the North, who knew nothing about southern conditions.

I have known this man to sit with those boys, and they were not at all interesting. I was one of them. He told us of the conditions in the South, and what it would be necessary for us to do, if we made good there and satisfied the people. That man struggled along. Among other things he has created favorable sentiment that has been crystallized into laws that now protect not only the cattle industry of the South, but protect humans as well.

I want to second the nomination of Dr. C. A. Cary. (Applause)

PRESIDENT VAN ES: Are there any further nominations? If not, all those in favor of the election of Dr. Cary as president for the ensuing year will signify by "Aye"; all those opposed. Dr. Cary is declared elected.

The next in order is the election of first vice president. Nominations are in order.

DR. W. M. MACKELLAR: I would like to place in nomination the name of a man who has long been connected with sanitary work in the Far West, and has probably traveled further to attend this meeting than any other in the room today. I refer to Dr. J. P. Iverson, of Sacramento.

. . . The nomination was seconded. . . .

PRESIDENT VAN ES: Are there any further nominations. If not, all those in favor of the election of Dr. Iverson as first vice president signify by saying "Aye"; all those opposed. The "ayes" have it and Dr. Iverson is elected first vice president.

Nominations are in order for second vice president.

DR. FITCH: Mr. Chairman, it is seldom that a man has the privilege, as I believe I have at this time. I was born and raised on a farm in Central New York. The veterinarian of my father was the man whom I am going to place in nomination for second vice president of this organization. His father was the veterinarian of my grandfather. He is a man who has always been inter-

ested in the veterinary profession. A short time ago he relinquished active practice in order to take up active work in the preservation of our food supply, in order to make it safe for public consumption. He is at the present time President of the Dairy and Food Inspectors of New York State. He is an officer in the national organization of dairy and food inspectors, and he has been honored by election as a Fellow of the American Public Health Association.

I have great pleasure in placing in nomination at this time the name of Dr. W. G. Hollingworth, of Utica, New York, as second vice president of this organization. (Applause)

DR. BIRCH: Mr. President, I am indeed happy to second the nomination of Dr. Hollingworth. As a member of the Association from New York, I can say that is unanimous there, and I hope it will be so here.

DR. W. J. BUTLER: The range state west of the Mississippi River joins with New York in the great pleasure of seconding the nomination of Dr. Hollingworth.

. . . The question was called for, put to vote and carried. . . .

PRESIDENT VAN ES: Nominations are in order for third vice president.

DR. A. W. MILLER: I would like to nominate a man who should be vice president, and I therefore place before the Association the name of Commissioner Felker of New Hampshire.

DR. DEFOSSETT: I think he is well known to this organization; he travels a long ways; he is a layman. He comes here for the expressed purpose of learning something to carry back to the New England states. He needs no flowery language of introduction. I want to second the nomination.

. . . The motion was put to a vote and carried. . . .

PRESIDENT VAN ES: That concludes the business. The Secretary-Treasurer, as you know, is elected by the Executive Committee.

I am sure you are all hankering for a taste of the new President, and with your permission I will ask Drs. Miller and Barger to conduct the new President to the rostrum so I may properly introduce him to you, if he needs any introduction.

. . . The audience applauded as Drs. Miller and Barger escorted Dr. Cary to the platform. . . .

PRESIDENT VAN ES: This is Dr. Cary, your new President, who will now take the burdens off my shoulders. Thank you.

. . . President Cary took the Chair. . . .

PRESIDENT CARY: Gentlemen, I can hardly express to you my heartfelt thanks for the honor you thrust upon me today, not with any anger, but with sympathy, love and respect of the position that is so great in this line of work. I have been elected president of the American Veterinary Medical Association. I want to say to you that in comparison with that, this was the easiest fight I ever had (laughter), and I want to thank my friends for the vigor and the unanimity in the fight they made for me, without any effort on my part. (Laughter)

I want to say to you that I will not make any promises like the young fellow who was recently ready to get married, and his fiancee said, "John, when we are married, you will come home every night at seven o'clock?"

"Yes."

"You will get up every Sunday morning and go to Sunday school and church?"

"Yes."

She went through the whole category, and when she got through she said, "John, you are such a damn liar, I won't marry you." (Laughter)

I am not going to promise anything today for fear you will call me on the eve of this happy occasion. I want to say to you I am not going to do any radical acts, I am going to let you do them, and if I can keep you in line, I will do it; if I can't, just have a riot any time you want to get ready. (Laughter)

I want to say to you I am going to look to you and the Secretary to do the work. I am going to be like the old nigger who was going into the army. They said, "Sam, what kind of an office do you want?"

He said, "I don't want to be a shave-tail second lieutenant, a first lieutenant or a captain. I wants to be a major."

The officer said, "Why, Sam?"

"A major don't do anything but sit around and do nothing."

I want to do nothing. (Laughter) Gentlemen, I am going to be the head of the gang. I am going to put you to work. We want to make next year the best year we ever had. I hope that we will break the record, and I will do my best to help you, but I am going to have you work with me. I thank you. (Applause)

DR J. I. GIBSON: There is one item of unfinished business, and it will take only a moment.

I have attended the meetings of this Association for a great many years. I have had the honor of the presidency, and I have had the greater honor of a wide acquaintance with the splendid gentlemen who constitute this Association. In my experience in the United States Live Stock Sanitary Association, and its work year by year, I do not recall a more successful year than the one that has just ended here, and much of that success, in my opinion, is due to the grand character and bearing of our outgoing President, Dr. Van Es.

Mr. Chairman, I move you that we all rise to our feet in recognition of his splendid administration and wish him good luck for the years to come.

. . . The audience arose and applauded Dr. Van Es. . . .

PRESIDENT CARY: Is there any other business before the meeting closes? If not, I don't know but what we ought to have the First, Second and Third Vice Presidents presented here, and have a speech out of them. (Applause)

I will request each gentleman to make a speech if he will confine it to two minutes.

FIRST VICE PRESIDENT IVERSON: Mr. Chairman, and Gentlemen: The office of Vice President is ordinarily regarded as being filled by one who can say "Yes" and "Amen," as the case may be, to anything the President suggests, and also it is regarded as being somewhat of the nature of an ornamental position. I feel, in the latter respect, that I can fill the office admirably. I am sure you will agree that I am one of the handsomest men in the room. Thank you. (Laughter and applause)

PRESIDENT CARY: This is an old member in our organization, from the great empire state of New York. I don't know whether he is older than I am, but I know he is a better man than I am. Dr. Hollingworth.

SECOND VICE PRESIDENT HOLLINGWORTH: I thoroughly appreciate it, and I am just going to say a few words. Food is the first necessity of life. It must be made safe by inspection and, from a public health point of view, beware of the high cost of the low price. (Laughter and applause)

PRESIDENT CARY: This is the only private in the whole army. He is from the great state of New Hampshire. He will tell you about it.

THIRD VICE PRESIDENT FELKER: Mr. President and Gentlemen: I esteem this a great honor coming to me and to New Hampshire, the way it has, from this splendid organization. As one of your vice presidents, I shall neither attempt alone nor with the help of the other two, if the movement is started, to change any rules of the Senate. (Laughter)

I feel that my people back home will appreciate the splendid thing you have done in recognizing that section in the northeast corner of our country. If they can't appreciate it, I am going to beat it into their heads. They say three times and out, and that is about the way it is with me. Thank you. (Applause)

PRESIDENT VAN ES: If there is no further business, we stand adjourned sine die until next year.

. . . The meeting adjourned at 4:40 p. m. . . .